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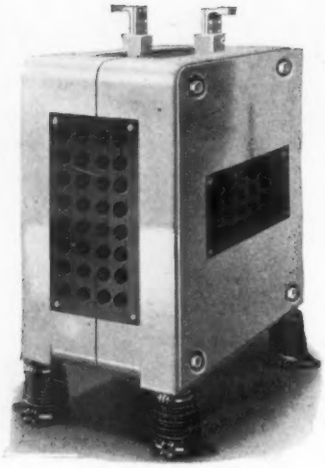

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Edison Illuminating Co.	Detroit, Mich.		
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Interborough Rapid Transit Co.	New York, N. Y.	Warren & Co.	Boston, Mass.
Joyce Gridland Railroad Co.	London, England	Westchester Lighting Co.	Mount Vernon, N. Y.
Municipal Gas Co.	Albany, N. Y.		
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Put More Style Into Lighting

THERE are many in the factory end of the lamp business who deplore the coming of the colored lamp —the flame, amber, lemon and other delicately tinted finishes that are beginning to gain favor in the public eye. It is not hard to understand their fears, because a keen popular demand for many colors will, if it be not watched, multiply the number of varieties in the dealers' stocks and run away with many profits.

But if these tinted bulbs bring the opportunity to endow the lamps themselves with a "style" appeal, much can be forgiven, for it may do as much to build popular appreciation of what light can do to beautify the home as any other thing that has yet happened. Style is the great sales builder. Let flame lamps become a fad, and people in ten thousand homes will be experimenting to see what effect the flame tint has on the wall paper and the rugs. Then they will try a lemon color, and so it will go. The idea will do much to arouse popular interest in the art of lighting, and such an interest will lead to both a more intelligent and a more bountiful use of light.

Muscle Shoals Still Unlikely to Go to Ford

ANOTHER stage has now been reached in the effort to intrust Muscle Shoals development to Henry Ford, the House of Representatives having passed the McKenzie-Madden bill by a substantial majority. At the same time it effectively killed every amendment which would tend to give the public the same protection, guarantees and assurance now demanded of all others who desire to undertake hydro-electric projects. The House even refused to give the State of Alabama the right to regulate, through its commission, electric rates which Ford might charge in that state. It takes no keen perception to detect the presence of an inexplicable political hypnotism which has put to sleep the common sense and better judgment of our representatives in Congress. The paradox of giving this great site to the richest man on earth—or, rather, giving it to his unknown successors—without adequate guarantee or protection, while at the same time Congress "investigates" ordinary business without cease and heckles admittedly able utility managements in connection with other water-power developments which they are willing to undertake under the federal water-power act, is surprising in the Congress of what we pride ourselves is the world's greatest democracy. This the Chicago *Tribune* forcefully pointed out in its editorial of March 12, quoted in part in last week's ELECTRICAL WORLD.

That the Senate and President will concur in the action of the House is possible, but surely doubtful. The more mature deliberation to be expected in the upper house should guarantee to the American public the full protection for Muscle Shoals that is guaranteed it in the case of all other water-power development. Senator Norris' announcement that the whole subject, and not merely the Ford offer, would be examined by his committee is an earnest of such deliberation. And the fact that if the matter should ever come before the President for action, he may look for advice to his three Secretaries who compose the Federal Power Commission is a further safeguard to the public's interest. These men above all other government officials have opportunity to see the beneficial effects of the present water-power act, which accords full justice and scope to those who operate under its provisions, and to predict with confidence what injustice will be wrought by such a grant as that proposed by the McKenzie-Madden bill. While anything may happen, there is yet much assurance that there will be, to use the *Tribune's* phrase, no "rape of Muscle Shoals."

What Does the Electrical League Do?

THERE is one natural question which doubtless occurs to most readers of the series of analyses of retail appliance sales appearing in the ELECTRICAL WORLD under the title "Who Sells Electrical Appliances?" That question is, "What part, if any, does an electrical league play in this side of the business?"

With this issue six of the studies have been published. In the three cities that have electrical leagues appliance sales were $2.90 per capita, while in the others they were $2.47—an apparent advantage in favor of the former of 17.5 per cent, but too small a margin from which to draw a definite conclusion that the league is directly responsible for greater merchandise sales.

From the observations of the ELECTRICAL WORLD'S investigator, and particularly from statements by the contractor-dealers themselves, the direct and material benefits of electrical league organization have been realized primarily in more wiring and fixture business. Electrical men in these cities say that there has been a considerable increase in the total number of electrical outlets per wiring job, and a higher grade of lighting equipment has been sold. Electrical league efforts have not been centered on the promotion of appliance sales or any single branch of the business, but, if anything, emphasis has been given to the need for better wiring in the customer's home so that he can make better use of the electrical conveniences available. This is as it should be.

That there is an indirect reflection of the influence of the electrical league in the appliance sales brought about by the increased number of outlets and more general use of electrical conveniences is, however, indicated in the general increase in such sales reported by most of the retail dealers. Part of the 25 per cent increase of 1923 over 1922 is directly attributed by these retailers to this definite influence on the public. Judging solely from detailed analysis of these few cases, it would

seem that the electrical leagues are performing a useful service to the industry and one probably more lasting than if they were directing all their effort toward immediate sales stimulation. Undoubtedly as these electrical leagues increase in number and in strength their direct influence upon merchandise sales will also become more evident.

Electrical Features of Power Stations Becoming Simpler and Better

WHILE the battle of the steam cycles is being waged and the stoker and pulverized-fuel general staffs are marshaling their forces the electrical features of station design await notice in the background. With little comment or controversy, great advances have been recorded in electrical equipment, principles of design and details of installation, so that the majority of station designers now agree as to certain fundamental conceptions and trends which lead directly toward standardization and simplification.

Of these principles positive excitation, all-electric auxiliaries and a secondary line of defense on all of the electrical installation are greatest; but, in addition, practice is tending toward a unity and simplicity which lead to a cheaper and a more reliable installation. While there are still differences as to the methods for obtaining positive excitation under all operating conditions, these may be explained on the basis of local conditions and their effect on layout and service requirements. The shaft-connected unit type of excitation is practically standard for the primary excitation source, and the differences exist in the means for insuring a reserve. The floating battery, the house turbine, the motor-generator exciter and the other variations encountered are not fundamental to the general solution of the excitation problem.

Probably the greatest diversity in opinion and practice exists in the choice of auxiliary power supply and in the relative advantages of different types of auxiliary motors. But here again the selection of the best way to back up the primary source of auxiliary power and the use of squirrel-cage, wound-rotor, brush-shifting or direct-current motors are matters of secondary importance which are governed largely by local conditions and the amount of capital it is advisable to invest. Yet the greater use of interconnected plants and the improvements in alternating-current motor design and control are very rapidly bringing about greater simplification and standardization in auxiliary layouts.

There is a decided tendency to eliminate low-tension main buses and use a generator and a transformer as a station unit with a group feeder bus, supplemented by a synchronizing bus, for stations in metropolitan districts. This simplifies the problem of protection, and by using differential and balanced relays a very reliable protection is obtained for each unit and for each separate machine. The number of meters of the indicating type is decreasing steadily, and instrument transformer compartments are becoming obsolete because of the development of these transformers for direct attachment to breakers and machines.

Phase isolation has aided greatly in securing a simple, reliable and convenient design in the switch house, and the development of improved interlocks, controls and breakers has increased the reliability of service. Better designs of reactors have been produced, and layouts have been made by predetermining every operating contingency and protecting against it on an exact quantitative basis. For high-tension-line stations the outdoor switching station reduces costs and increases flexibility.

Thus, in comparison with the other features of modern stations, the electrical designs are far advanced. In great measure this has come about because the fundamental and quantitative laws of electricity have been available and have been applied in a scientific manner to the development of equipment which had no background of tradition or precedent. Electrical engineers are particularly fortunate in having their science thus quantitatively subdued, and all engineers will welcome the time when combustion principles and thermodynamic data are available with the same exactness.

Load Indicators for Distributing Transformers

IN THE recent past there has been considerable demand for an indicator designed for use on distribution transformers that would make it possible to operate these transformers more economically. In the last two years several of these indicators have come on the market, but there has been little evidence of a general application of them by the power companies. Although there have been a few notable exceptions where satisfactory results have been reported, none the less, in view of the insistent assertion of the necessity for more economical operation of distribution transformers, the reason for the slow progress evident in the adoption of transformer load indicators and the equally slow progress made by the manufacturers in bringing about further developments should be found and a remedy applied. The best means of accomplishing this result are not definitely enough known to prompt intensive action.

A study of transformer operation appears to disclose three methods of obtaining information that properly used will improve operation. These are:

1. Spot tests made at time of peak load. These will provide a means of properly taking care of normally growing conditions, but will not always be adequate to meet abnormal conditions such as rapidly growing loads. In any case these tests must be made at regular intervals and particularly often where abnormal conditions are expected. One great advantage of spot tests, if made on the secondary side of the transformers, is that they can be conducted so as to determine the direction of the loading on the secondary wires and the balance of the load on these wires.

2. The use of a temperature indicator to indicate dangerously high load conditions and of spot tests to find underloads. This will decrease the number of spot tests required and permit the operation of transformers nearer the danger points because of the possibility of closely watching the indicators of all transformers. Greater economy can thus be obtained.

3. The use of recording load indicators. Spot tests will not be necessary in this case to find transformer loadings, and proper and periodic inspection will permit of operating conditions similar to those just stated.

It would therefore appear that there is a place for a cheap, accurate and easily visible danger signal and also for a load-recording instrument that would be reliable and not prohibitive in cost. The operator, knowing the condition of his system, knowing the available equipment on the market and considering the cost of both equipment and labor, should determine which one of the three above means will result in the best economy on his distribution transformers and should then adopt it.

Motion Pictures Aid Testing Staffs

IT HAS become increasingly evident during recent months that motion pictures have a utilitarian value to engineers as technical keys for unlocking many doors to increased efficiency in investigation and operation. One of the most recent applications of such pictures is to record simultaneously the readings of many indicating meters. In machine or plant tests requiring the accurate and simultaneous readings of many instruments much difficulty has been experienced because of the limitation of time, the number of readings required and the inaccuracy of readings made in a hurry by human observers.

By the use of motion pictures it is possible to arrange the meters in a manner to expose the dials to the camera and to obtain a continuous and accurate series of records which can be read and interpreted at any later time in a leisurely manner. In power stations, research and test laboratories and industrial plants this new tool for testers is sure of a welcome, and a little study shows a multitude of other engineering applications of a similar character where it can advantageously be employed.

Even before this use of them was made motion pictures had in the work of engineers taken on as many forms as Proteus, adapting themselves with surprising ease to a wide range of activity. They record data, visualize production processes and aid mechanics to assemble or install equipment, besides serving the commercial and human purposes of advertising equipment, factories and persons, entertaining and educating employees and the public, and helping to sell service, apparatus and merchandise. No doubt this new application to testing presages still more ingenious methods for using the camera in other industrial and engineering activities.

"Scabs" in Business

IN THIS day, when so much conversation is heard in criticism of the so-called "curbstone" contractor, the "pirate" jobber and the "bootleg" manufacturer and their disturbing influence on the balance of trade in the electrical industry, it may not be amiss to point out the interesting fact that there are certain fundamental liberties guaranteed to all men by the Constitution of the United States which may have a direct bearing on this situation in the industry. For instance, except as limited by law, every man has a right to carry on his business in his own way. Just as a non-unionist is as much entitled to work as a member of the union, so a manufacturer or merchant is as much entitled to carry on business in a manner satisfactory to himself as are other manufacturers and merchants who feel that the plans of operation which they have found satisfactory after much experience and careful consideration are the best.

There are certain economic laws which, if followed, bring their own rewards, and if not followed, bring ruin. But it is difficult for a group of competitors who are co-operating for the good of the industry not to try to hasten the punishment that one outside the group is bound to suffer for not following these economic laws. And it is very difficult for them to remember that there is no right in law or in equity for their interference with the business of such an outsider.

Those known in business as "cut-price houses," "pirates" and "gyps" generally cannot long survive the conditions they make for themselves, but in any case they are entitled to the enjoyment of liberty from interference by their competitors. Recognition of this principle insures fair treatment and avoids serious legal questions. It leaves the result of individual action by each member of the industry to be determined by the play of competition conducted on lines acknowledged to be proper.

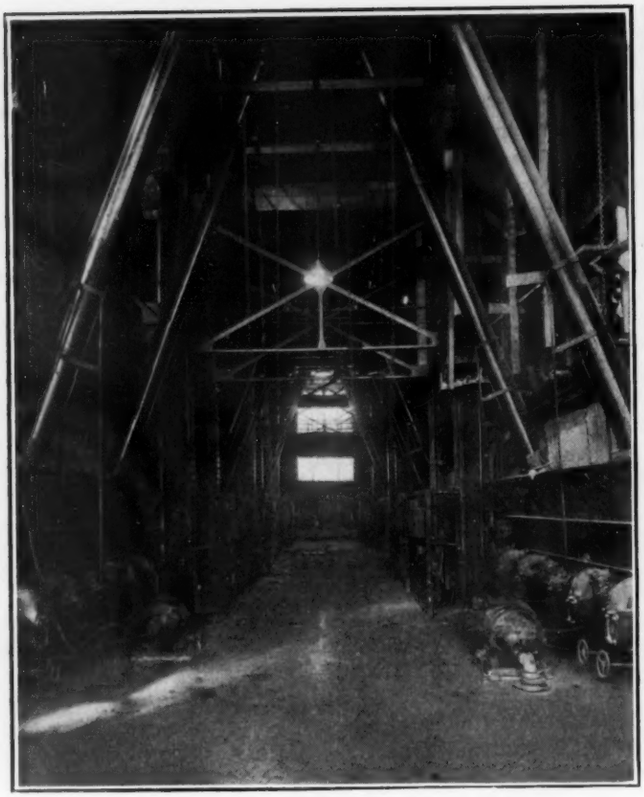
The "curbstone" contractor and the "cut-price" jobber may be a menace to the established industry, but it is futile to waste time in even talking of any course of action other than one which would aim by education to raise the standard of these men. They are here. They have the right to render any form of service that they desire, and they can continue so long as their customers will support them.

An Interesting High-Tension Plant

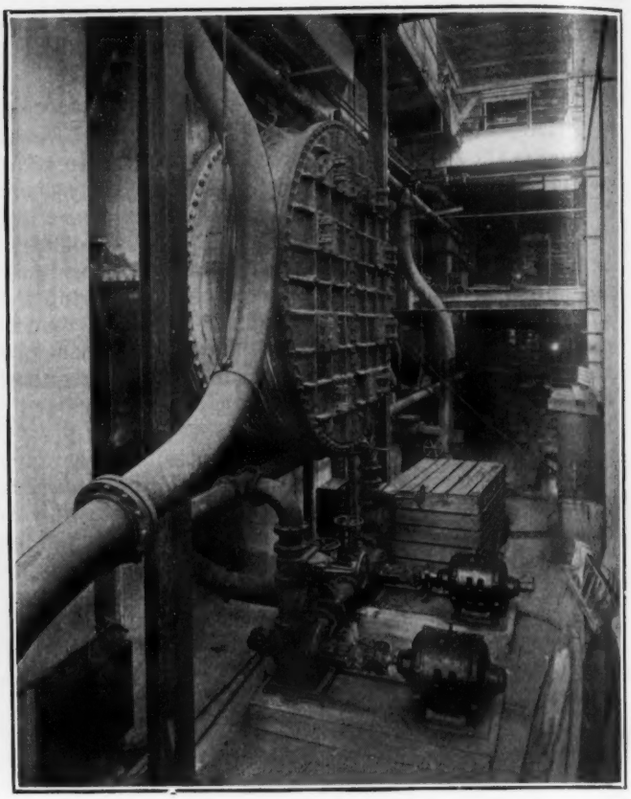
THE new Devon station of the Connecticut Light & Power Company, described elsewhere in this issue, is the latest large New England generating plant to attract engineering interest, and although many features of its design are devoid of the spectacular and of the untried, the installation is both significant and important. The designers evidently sought after reliability of service as the first essential of this development, and in working toward this goal a remarkable simplicity of electrical arrangement was made possible by the fact that Devon is not a local station but perhaps the best example of a steam plant of the purely "superpower" type which New England has yet seen.

It is no criticism of other plants in the Northeast to emphasize this striking feature of the Devon design. Weymouth (still under construction), South Meadow, Montville, Montaup (only recently started) and many stations besides are designed to fit into superpower requirements; but at Devon one finds a plant which, although it lies between the cities of New Haven and Bridgeport, has no present local load whatever in this pre-empted territory and must seek its field of service up and down the Naugatuck Valley and in other areas of western Connecticut miles distant from its own buses. Through interconnection this plant is bound to perform most valuable duty apart from the immediate serving of the company's customers, and the people of Connecticut are to be congratulated upon the addition it brings to their power resources.

To the electrical engineer Devon is of particular interest on account of the omission of the usual low-tension generator bus and feeder structures and switching details and the virtual establishment of 66,000 volts as the bus potential of the plant. This is very nicely cared for by a symmetrical and spacious outdoor substation, with excellent provision for future expansion. On the mechanical side Devon illustrates nothing in the way of exalted steam pressures, but it exemplifies a heat-balance control of flexibility and evident freedom from complications, a finely co-ordinated system of unit piping development centering in or "anchoring on" a seven-opening manifold, boiler settings of advanced design, turbine stage bleeding and turbine units with attractive performance guarantees over a decidedly useful load range, and an interesting evaporator installation to enable brackish water to be used for boiler make-up. The liberal but not excessive space allowances made throughout the entire plant speak well for the operating sense of the designers.



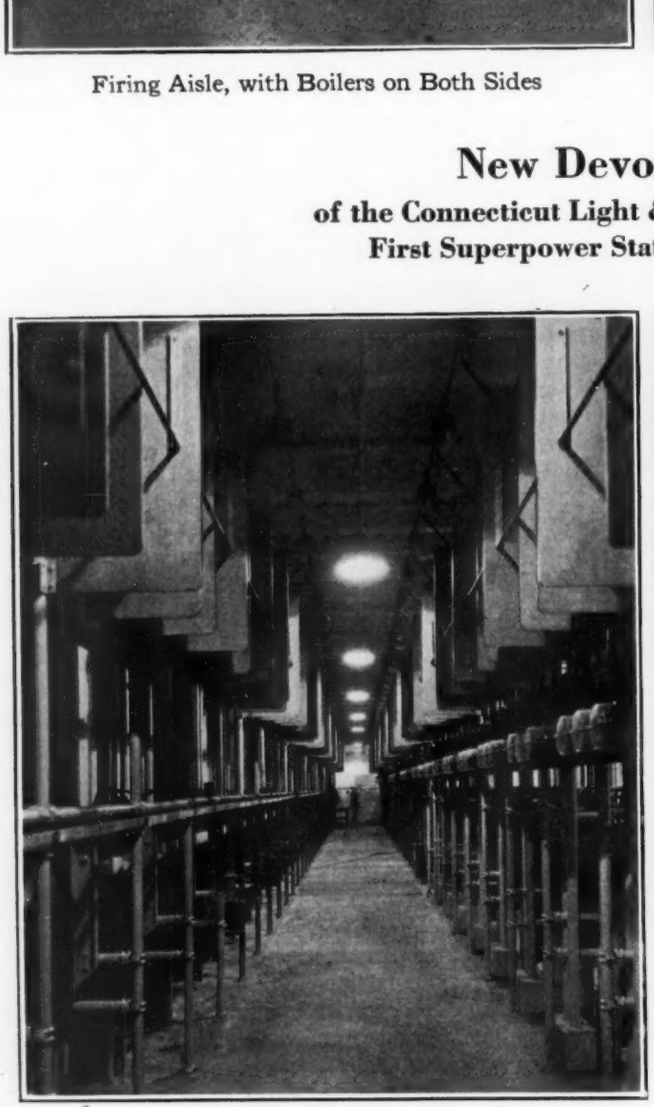
Firing Aisle, with Boilers on Both Sides



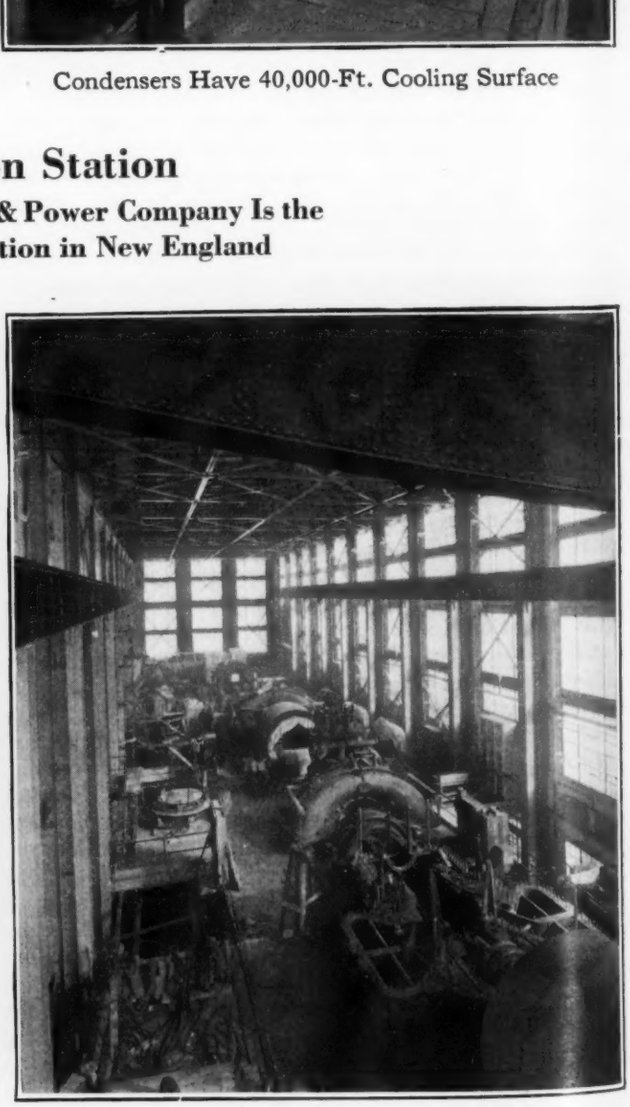
Condensers Have 40,000-Ft. Cooling Surface

New Devon Station

of the Connecticut Light & Power Company Is the First Superpower Station in New England



Station Service Room, Showing Compartments, Barriers and Relays



Turbine Room During Construction, Showing the Bauman Blading in Turbine

Devon Station Marks Forward Step in Development of New England Superpower

New Base-Load, High-Tension Plant of Connecticut Light & Power Company Is Designed for 200,000-Kva. Rating — Mechanical and Electrical Features Emphasize Reliability and Economy of Service

Significant Features of the Devon Station

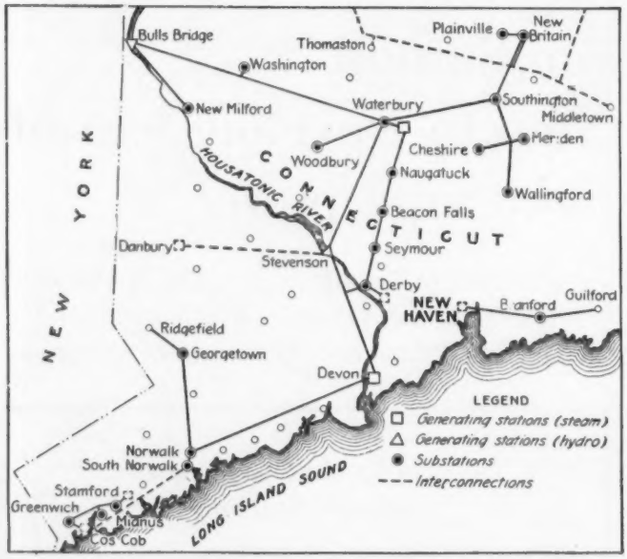
DESIGNED for 200,000-kva. ultimate rating, the new Devon steam plant of the Connecticut Light & Power Company fits into a comprehensive system of power supply for the greater portion of southwestern Connecticut and is well adapted to superpower co-ordination. Among its notable features are liberal but not excessive space allowances, provision for handling fuel, water and ashes in bulk, extensive coal storage, use of brackish river water for make-up, elimination of many complications in bus and cell construction, and effective use of outdoor bus and circuit-breaker facilities. Other interesting points are the provision of an emergency turbine for auxiliary service, normally floating on the bus with its generator functioning as a synchronous condenser; the absence of compensators for motor starting; widespread use of motor-driven auxiliaries, and a well-controlled heat balance based on the use of stage bleeding and flexible evaporating equipment. A special design of boiler setting, use of simplified switchboard apparatus with improved terminal arrangements and an unusually large initial installation of generating units also attract the attention of engineer visitors.

THE new Devon station of the Connecticut Light & Power Company, about to begin operation near the mouth of the Housatonic River on Long Island Sound, illustrates the increasing importance of designing such plants with regard to regional demands for electricity and emphasizes the weight of fuel and water supply conditions in the problem of site selection for a generating installation of such magnitude. A large portion of southwestern Connecticut is served by this company, whose generating plant capacity has grown from 500 kw. in 1894 to 120,950 kw. in 1924. An important section of the company's territory is highly developed industrially, the Naugatuck Valley, lying between Waterbury and Derby inclusive, forming a manufacturing district whose demands for power, present and prospective, have increased greatly through the use of the electric furnace in the melting of non-ferrous metals and for various heat-treating processes. Most of the factories of this section of the state are allied with the metal-working industries, and not only the larger cities but many of the small towns contain plants which require electricity in quantities seemingly all out of proportion with the size of the community. In general, the larger cities are only 20 miles to 30 miles apart, and the value of interconnection has been repeatedly demonstrated.

To meet the rapid increase in system load and afford opportunity to tie in the plant with existing companies and with future superpower developments, the Devon station has been designed. The accompanying map of the system shows the relation of Devon to the existing hydro-electric plants of the company at Bulls Bridge and Stevenson and to the present steam plant at Waterbury. These water-power stations have a combined rating of about 26,000 kw., and at Waterbury from 18,000 kw. to 23,000 kw. can be generated, depending on the supply of condensing water. Near New Britain the system is interconnected with the Connecticut Power Company and the Hartford Electric Light Company, and the Norwalk division will be tied in with Devon through a new transmission line.

An exhaustive study was required to determine the site at Devon. A superficial glance at the map of Connecticut seems to show many places on Long Island Sound or on the various rivers of the state suitable for superpower plant development. But close examination showed only three points in the state where adequate condensing water and other necessary conditions could be met for a plant of this character. These sites were respectively on the Thames, the Connecticut and the Housatonic River. With the completion of Devon there will be a large station on each of these rivers at the apexes of an equilateral triangle measuring about 50 miles on a side—the South Meadow plant at Hartford and the Montville plant near New London completing the trio. The chief factors influencing the location at Devon were ample condensing water, coal supply and storage, reasonable proximity to the load supplied and facility for the location of radiating transmission lines.

The Devon plant is on a plot about 60 acres in area adjoining the main line of the New York, New Haven & Hartford Railroad. A present coal yard of 50,000 tons capacity is provided, and both rail and tidewater coal will be available, with double this in ultimate storage. The initial installation of generating units provides for 75,000 kva. in three machines. At the



MAP OF CONNECTICUT LIGHT & POWER COMPANY SYSTEM

elevation of the main railroad tracks is a coal trestle beneath which 40,000 tons can be stored, 10,000 tons more being stored beside the trestle. The trestle track, 1,085 ft. long, is carried through the yard to the track hopper looping around the station back to the main-line tracks. Provision has been made in the trestle for the installation of a future track scale. The track hoppers and crushers are installed below the trestle so that coal can be dumped directly from the cars into the coal-handling equipment and delivered to the boiler house.

At present the only equipment provided for reclaiming coal is a locomotive crane and a steam shovel with caterpillar tread. It is planned in the near future to build a dock along the Housatonic River roughly parallel to the coal trestle, and when the plant requires it it is probable that a bridge will be utilized, with one leg resting on the face of the dock, employing a cantilever end for unloading barges and storing coal in the area between the present high track and the dock. On account of the considerable fill and inclosure with sheet piling required, the work has been postponed. It is noteworthy that the ultimate coal-storage capacity of 100,000 tons would fill the famous Yale Bowl.

The building is a steel structure with tile outside and inside walls, the structure and machinery foundations resting on concrete sub-foundations carried down to a solid gravel structure underlying the site. The present dimensions are: Boiler house, 130 ft. x 98 ft.; turbine room, 225 ft. x 57 ft.; control house, 40 ft. x 27 ft.

Two self-supporting steel stacks, each 25 ft. in diameter at the base, 19 ft. in diameter at the top and 320 ft. high above the boiler-room floor, are provided.

Beneath the track hopper is a coal-crusher installation with a capacity of 120 tons per hour. From the crusher equipment double-balance skip hoists, each with separate hoisting unit, transfer the coal into the building, delivering it into a receiving hopper and thence to automatic loaders and two horizontal belt conveyors running the length of the boiler room above an overhead bunker of 700 tons present capacity. This will be increased to 1,800 tons in the ultimate boiler room. Each belt is equipped with a Merrick "weightometer."

The station building, as shown in the accompanying cross-section, is occupied largely by steam generating and auxiliary equipment, the electrical design being remarkably simplified by the fact that all power is sent out over a few high-tension transmission lines. The generator leads connect direct to the low-tension terminals of step-up transformer banks in an outdoor bus structure from which 66,000-volt lines lead to the other plants and load centers of the system.

Six boilers have been initially installed. In the ultimate plant there will be four groups of four boilers, with six turbines, it being assumed that this number of boilers will have sufficient capacity to operate five turbines. The sixth machine is to be considered a spare unit. Each boiler is rated at 1,680 hp. and is of the horizontal water-tube type of cross-drum construction. The grate surface is 333 sq.ft., the furnaces being 15 ft. deep. Each boiler is designed for 320 lb. working pressure and is twenty-two tubes high and forty-eight tubes wide, with an interdeck superheater between the tenth and eleventh rows of tubes. To form a slag screen every alternate tube in the bottom four rows has been omitted. Each boiler has twenty-two soot-blower heads, placed nine on each side and two on each end of the boiler, the end soot blowers being immediately above the superheaters. These blowers are of Vulcan design, with valves in the head.

Boiler Settings Take Care of Expansion and Contraction

The boilers are arranged on two sides of a central firing aisle. Four boilers, two on each side of the aisle, discharge into a common stack. Each boiler is equipped with a twelve-retort, twenty-seven tuyère Westinghouse underfeed stoker. These stokers are designed to burn a maximum capacity of 1,400 lb. of coal per retort per hour and are equipped with double-roller clinker grinders and agitators in the stoker magazines. Coal is delivered from the overhead bunker direct to the stoker magazine through swinging-down spouts. Every third retort of the stoker is provided with a revolution counter. The stokers were purchased with extension side-wall tuyères, but in addition the company is using carborundum brick 18 in. thick above these side tuyères and also on the front wall. On the rear wall hollow Bernitz blocks are used. The walls on all four sides of the boiler slope toward the outside and in addition are concave, to eliminate any tendency on their part to fall inward. Firebrick is used throughout the entire thickness of the wall. The two side walls and the rear wall are provided with an arch construction carrying the section of the boiler above it. Thus sections below can be replaced without taking down the entire wall. The stresses in the setting are taken up by specially designed steel framing, and careful provision has been made against expansion and contraction in the setting.

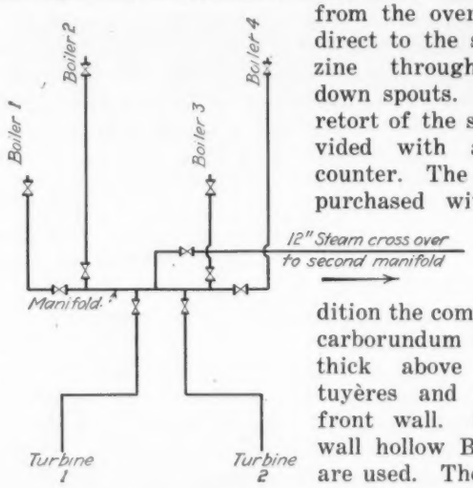


DIAGRAM OF MANIFOLD PIPING CONNECTIONS

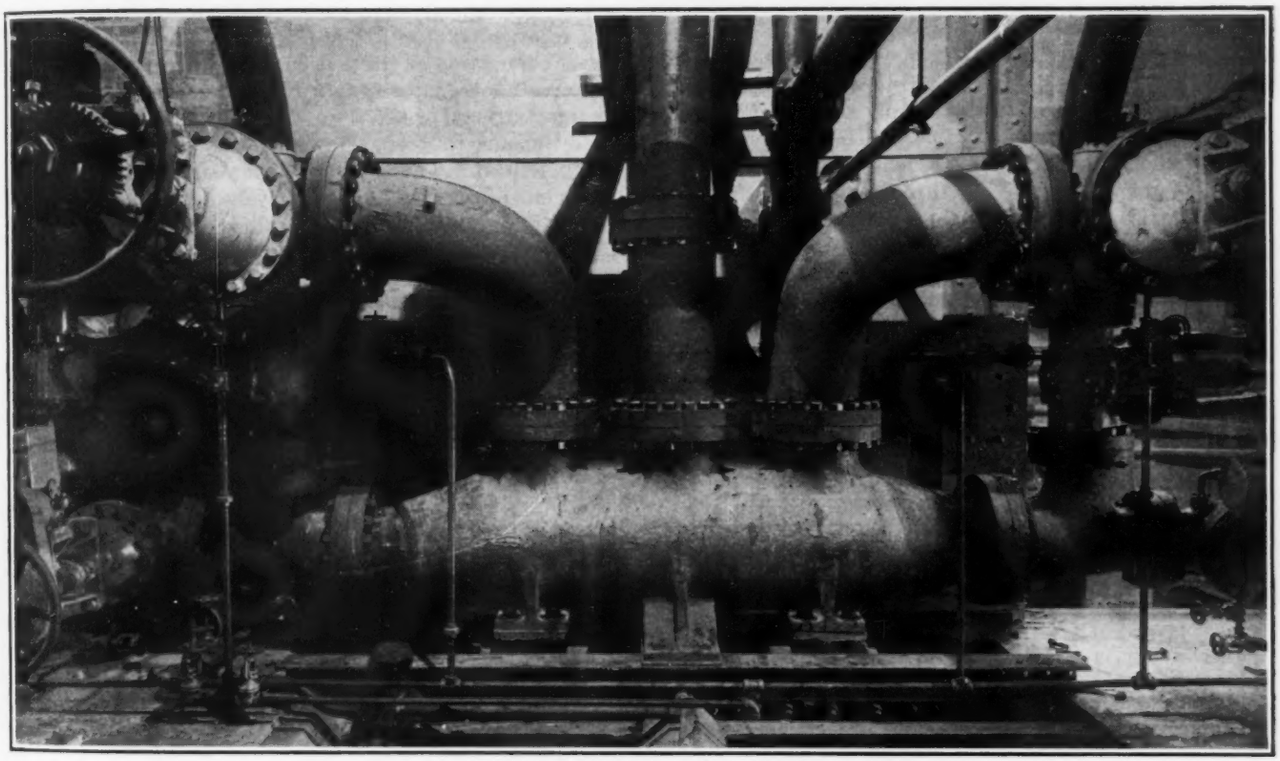
Space has been provided above the boilers for the future installation of unit economizers.

Ash gates and hoppers are of Baker, Dunbar & Allen design and are of cast iron lined with firebrick. Below the boiler-room operating floor is a basement 27.5 ft. deep, arranged on each side of the boiler room for the removal of ashes in standard railroad cars. The ash gates are 5½ ft. x 6½ ft. and are equipped with air cylinders, also having water troughs and drains to prevent water used in quenching above the clinker grinder entering the basement. Ashes are dumped directly from the hoppers into the cars.

The boiler combustion control is by the Benjamin system, in which a master regulator in the main steam piping governs a motor-generator set supplying field current for direct-current-driven forced-draft fans and for stoker motors. In addition, a Benjamin damper controller governs the opening of the rear damper on individual boilers according to the pressure above the fire. Hand control is also provided for use when starting up and shutting down a boiler or for temporary operation. All boiler auxiliaries are operated by 250-volt direct-current motors except the feed pumps, which are Cameron four-stage turbine-driven centrifugals, each with a capacity of 750 gal. per minute. Individual fans are provided for each boiler, and these are installed on a fan floor 12 ft. 6 in. below the boiler floor, in the center of the boiler house and immediately below the firing aisle, a minimum clearance of 6 ft. 6 in. being provided between housings in the fan-room aisle. To provide the equivalent of a spare fan, an emergency air duct was installed under each row of boilers connecting together the fans on the corresponding side of the boiler-room center line.

Liberal but not excessive space is provided in the boiler house for a pipe gallery on the side toward the turbine room, for feed-water heating and evaporator equipment, surge tanks, toilet and locker-room facilities and for switching apparatus to supply station service. The main steam piping is arranged so that each group of four boilers discharges into a common manifold. The manifold is a single steel casing with four inlets, one for each boiler, and three outlets for turbine and cross-over connections. The manifold is the anchor point of the steam piping. Van Stone joints are used throughout.

The turbines are Westinghouse single-flow units of Bauman design and are equipped with two-stage bleeder heaters. The bleeder points are placed at approximately



MANIFOLD FORMS ANCHOR POINT FOR HIGH-PRESSURE STEAM PIPING

3.2 lb. absolute and 13 lb. absolute when the unit is operating at 16,000 kw., the point of maximum efficiency. The guaranteed steam consumption of these turbines is as follows:

Output, Kw.	Power Factor, Per Cent	Lb. Steam per Kw.-Hr.
5,000	90	13.83
10,000	90	11.5
16,000	90	10.7
20,000	90	10.85
22,500	90	11.08
25,000	100	11.25

The turbines are designed to operate at 285 lb. pressure at the throttle valve, on 28.5 in. vacuum, with 200 deg. superheat and at 1,800 r.p.m.

The condensers are of Westinghouse design and of the radial-flow type with divided water boxes. Each has 40,000 sq.ft. of cooling surface and is provided with 1-in. No. 18 gage Admiralty tubes. Each condenser is equipped with two circulating pumps, either of sufficient size (28,000 gal. per minute) to give a vacuum of 28.5 in. with 60-deg. circulating water or 28-in. vacuum with 70-deg. water. The two circulating pumps operating together give 28.5-in. vacuum with 70-deg. water and 28-in. vacuum with water at 80 deg. Two motor-driven condensate pumps are provided with each con-

denser. Two Westinghouse-Leblanc air pumps furnished with each condenser are designed to handle 10 cu.ft. of free air at 70 deg. F. and 28.5 in. vacuum.

BRACKISH MAKE-UP WATER USED

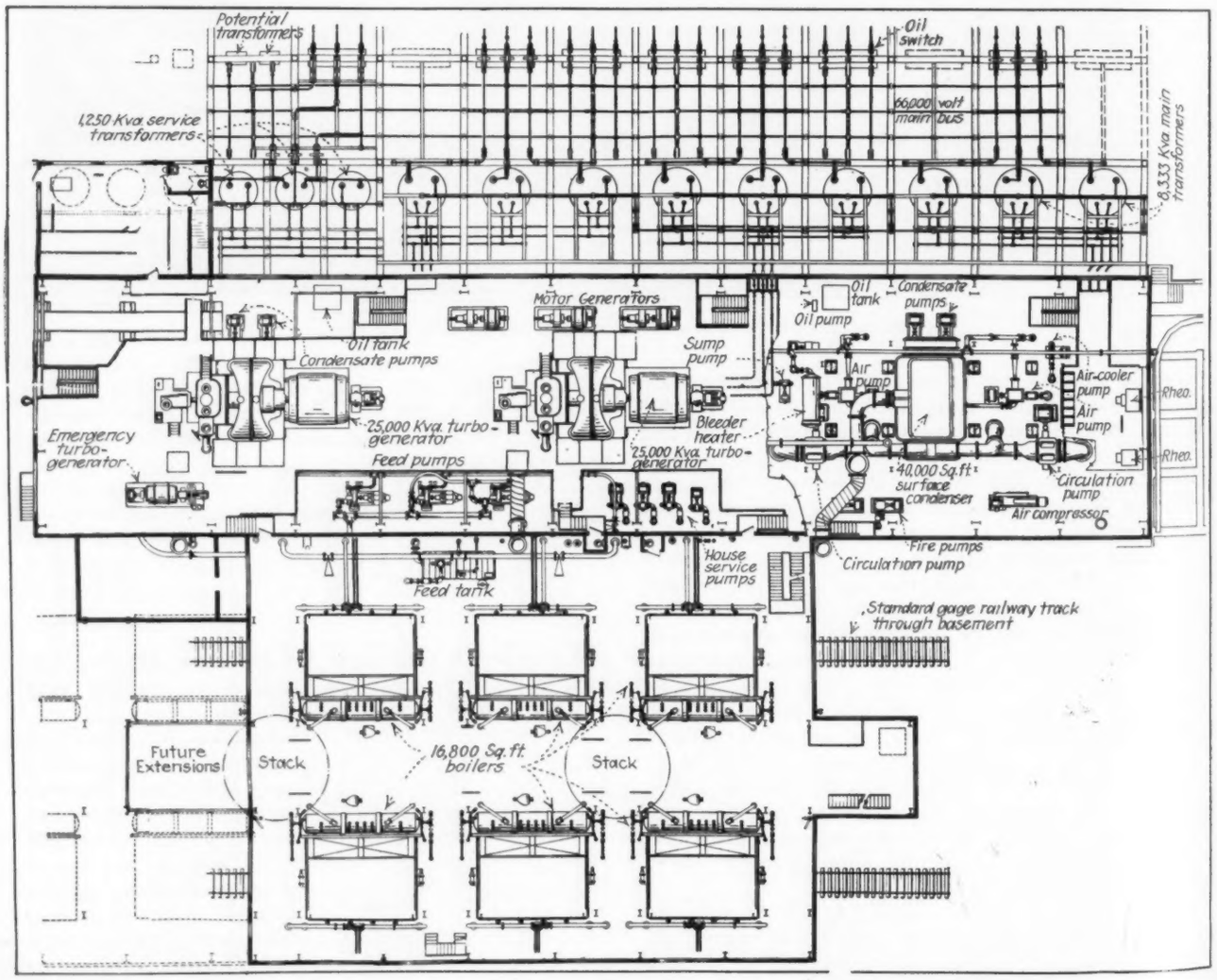
The boiler-feed pump suctions are taken off an open feed-water heater as shown in the accompanying heat-balance diagram. As the plant is built on tidewater, the condensing water will be brackish and make-up water will be supplied from the river through an evaporator installation. Sufficient tank capacity has been installed to store make-up water for the plant during periods of ebb tide when the river water shows the lowest salt content. A recent water analysis showed total solids of 1,703.06 grains per gallon at high tide and 55.385 grains per gallon at low tide. An emergency connection to the water-supply service of Milford, Conn., is provided.

The general heat-balance scheme is to pump condensate from each machine through its two stages of bleeder heating and then to the open feed-water heater. The exhaust steam from the boiler-feed pumps is used in the open heater to raise the temperature of the condensate, and the drips and make-up from the evaporators are also introduced into the feed system in the open feed-water heater. The boiler-feed-pump suctions are taken off the open feed-water heater. Storage tanks are provided with 15,000 gal. capacity per turbine, and these float on the condensate line between the discharge of the condensate pumps and the inlet to the first stage of the bleeder heater. The boiler-feed piping forms a loop in the fan floor. This loop is provided with two sources of supply, one of which bypasses the high heat-level condenser on the evaporator system. The intake and discharge tunnels are built in the concrete foundations of the turbine room, the former being provided with three revolving screens. The tide range is normally 5 ft., with a maximum of 11 ft.

ELECTRICAL DESIGN SIMPLE YET FLEXIBLE

The elimination of a generating voltage bus greatly simplifies the station design on its electrical side. The direct connection of the 13,900-volt generator leads with the step-up transformer primaries without any intermediate circuit breaker or disconnecting switch practically means that 66,000 volts becomes the generating bus potential. The accompanying single-line diagram of wiring illustrates how effectively a flexible and symmetrical layout has been obtained in the design of high-tension buses, circuit breakers and outgoing transmission-line connections, as well as in low-tension auxiliary equipment.

Other features of note are the supply of a station service bus direct from the 66,000-volt main station bus through transformer banks of very high reactance, the supply of the station auxiliaries through a station serv-



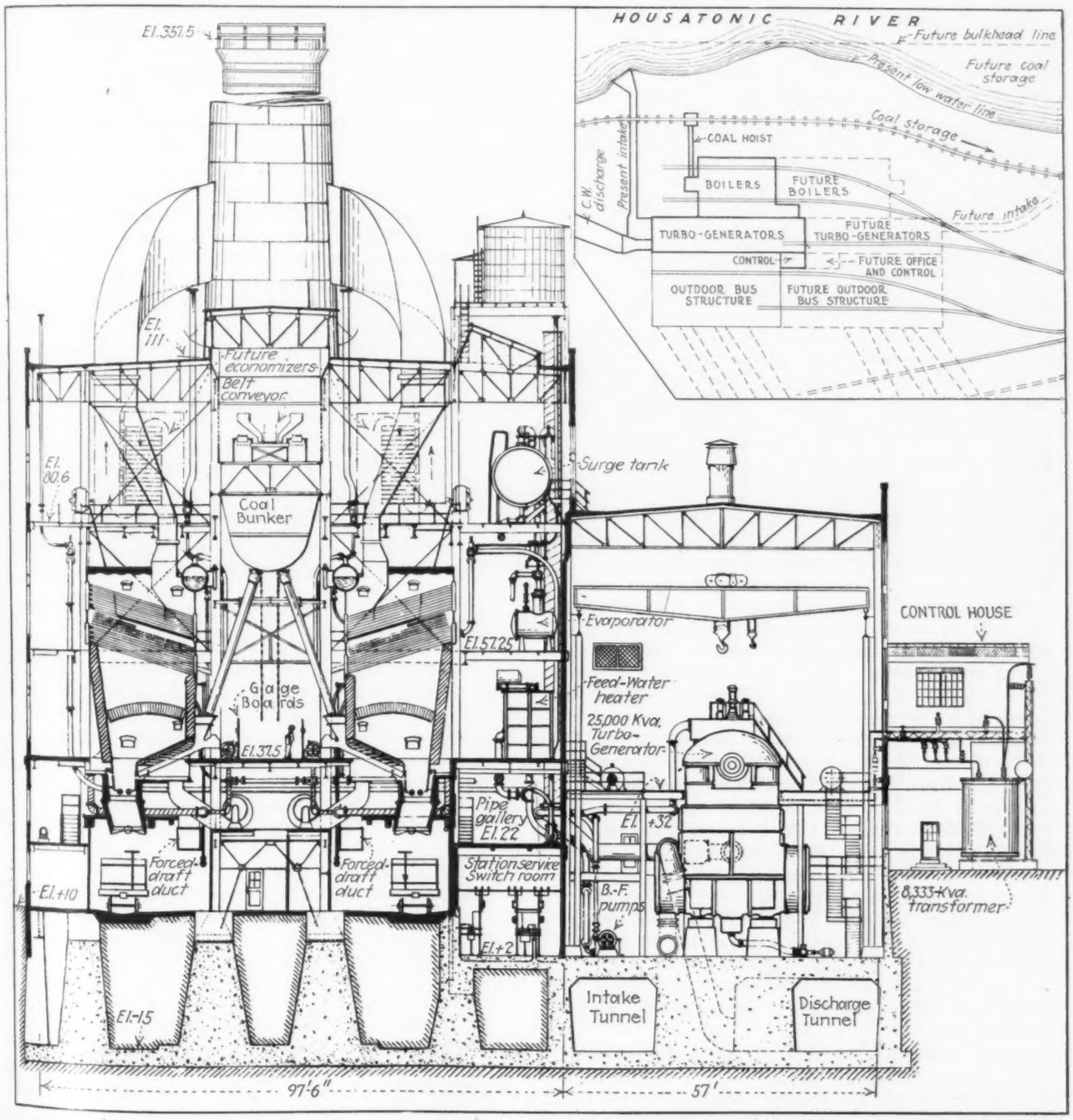
STATION BUILDING OCCUPIED LARGELY BY STEAM-GENERATING AND AUXILIARY EQUIPMENT

ice bus which consists of a main 2,300-volt bus, an auxiliary 2,300-volt bus and an 1,150-volt starting bus for 2,300-volt motors and an emergency turbine of 1,250 kva. capacity.

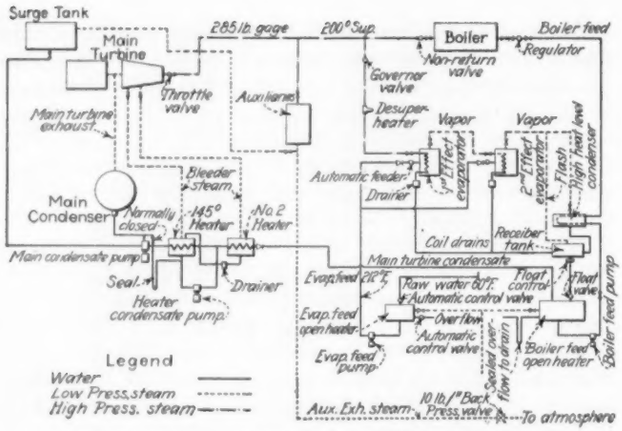
This emergency turbine will ordinarily float on the station 2,300-volt bus, a tie switch connecting the main and auxiliary 2,300-volt buses together. This switch will open and segregate the main 2,300-volt bus when disturbances occur on the main generating system. The emergency turbine when floating on the bus takes practically no steam, but is kept cool through a connection to the condensers of the main generating units. It is always excited sufficiently to carry the load on the main station service bus at proper voltage when the tie switch opens. Being thus excited, it will act as a synchronous condenser on the station service bus.

Some of the other electrical features of this station are alternating-current drive of practically all auxiliaries, motor-generator sets for 250-volt direct-current power for the supply of variable-speed motors in the boiler room, simplified excitation, with shaft end exciters and without automatic voltage regulation, and a starting bus for the 2,300-volt motors with the elimination of starting compensators.

The electrical layout of the main bus is of unusual design in its simplicity. A double outdoor 66,000-volt bus is installed adjacent to the station with two oil circuit breakers per feeder and per generator. The switch-control room is at the center of the completed station, separated from the power plant proper, with a control-circuit terminal room below the main control room. Differential relay protection is provided on the gener-



CROSS-SECTION OF PLANT, SHOWING SIMPLICITY OF ELECTRICAL DESIGN. IN THE UPPER LEFT IS A PROPERTY PLAN OF THE STATION



HEAT-BALAN DIAGRAM FOR 75,000-KVA. PLANT

ators and transformer banks and on the 2,300-volt motor circuits, and the out-going 66,000-volt lines are provided with balanced relay protection. Emergency lighting is supplied from a 250-volt storage battery.

LAYOUT FOR 200,000-KVA. ULTIMATE RATING

The present installation consists of three 25,000-kva. generators operating at 90 per cent power factor, or an aggregate generating capacity of 67,500 kw. The layout provides for an ultimate capacity of 200,000 kva., in which event the building will be extended in the future for three 40,000-kva. machines. Each generator has a direct-connected exciter without automatic regulation, because the plant will carry the base load of the system with water-power stations operating on the peaks. The generator fields are connected through rheostats to the exciter armatures, field control being obtained by adjusting the exciter-field rheostat and the generator-field rheostat simultaneously. This is made possible by a single-face plate rheostat which includes both the exciter-field and generator-field rheostat contacts. These rheostats are installed on the mezzanine floor below the main operating-room floor. The neutral-current transformers and the generator-potential transformers are installed in compartments on the mezzanine floor. Another set of current transformers acting in conjunction with these is installed in compartments at the ends of the generator leads at a point where these leads go through the station wall to connect to the transformer banks. There is another set of current transformers in the 13,900-volt leads at this latter point, which operate in conjunction with current transformers on the 66,000-volt side of the transformer bank. These current transformers are connected differentially to relays which trip the transformer bank high-tension oil circuit breaker, generator-field breaker and overspeed device on the generator in case of internal trouble on the generator or in the transformer bank. Six temperature thermocouples are buried in each generator winding at possible hot-spot locations and connected to a temperature recorder in the main control room as a guide to safe loading of the generator. There are also provided two extra thermocouples, one in the intake and one in the discharge of the ventilating system of the generators, which are also connected to the recording instruments.

Leads from the generators run under the turbine-room floor and through the wall of the station, connecting directly to the low-tension terminals of the 25,000-kva. step-up transformer banks, each transformer bank having the same rating as the generator. One spare transformer of 8,333 kva. rating is provided with these three banks. The main generator leads consist of bare copper busbar supported by post insulators mounted in inverted concrete troughs under the generator floor. Between phases are concrete barriers to prevent interphase short circuits.

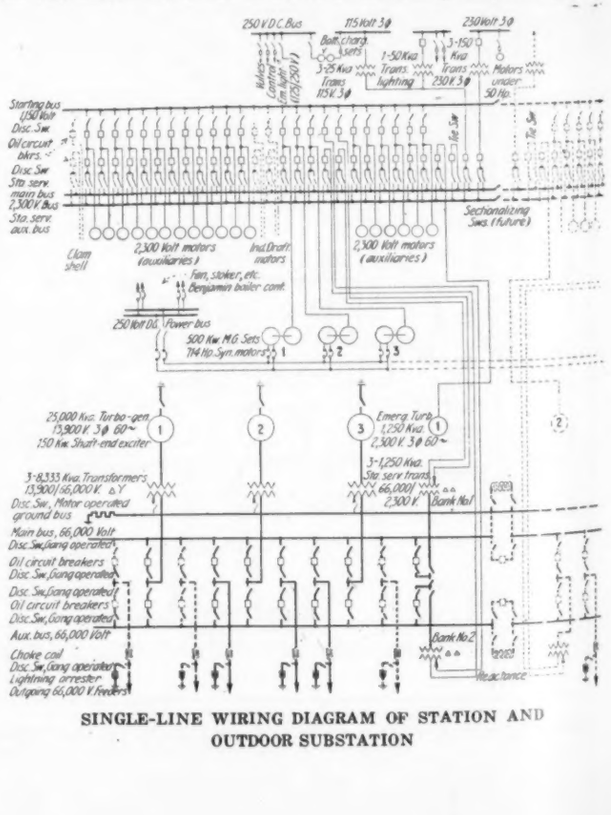
The outdoor bus structure consists of double 66,000-volt buses supported in suspension by five Jeffery-Dewitt insulators. The main and auxiliary buses are in separate bays, the width of the bay being 24 ft. between center lines of the columns. All the steel of the outdoor structure is galvanized. The feature of this outdoor bus structure is simplicity of design and liberality in spacing. The design consists of two oil circuit breakers per main transformer bank and two oil circuit breakers per feeder, although in the initial installation some of the duplicate oil circuit breakers were omitted in order to keep down the expenditure. Another feature of the outdoor structure is the use of Jeffery-Dewitt pedestal insulators for bus, disconnecting switch, current-transformer and choke coil supports. The pedestals are made up of five Jeffery-Dewitt insulators which have a dry flashover at 60 cycles of 340,000 volts and a wet 60-cycle flashover of 180,000 volts. The outdoor disconnecting switches are of the manually gang-operated, three-pole, single-throw type, with the exception of the disconnecting switch used for grounding the neutral, which is motor-operated and controlled from the main control room.

Power for the station auxiliaries is supplied by two 3,750-kva. transformer banks, each large enough to carry the entire load, located outdoors and stepping down from 66,000 volts to 2,300 volts. These transformers have differential relay protection.

All of the generator, feeder and station service bank oil breakers are rated at 400 amp., 73,000 volts.

NO BENCHBOARD PROVIDED

Control of this apparatus and starting and stopping of the generators are supervised in a main control room on the third floor of a control building adjoining the


250 V D.C. Bus
115 Volt 3φ
230 Volt 3φ
Batt. charg. sets
3-150 Kva. Trans.
3-25 Kva. Trans. 115 V. 3φ
1-50 Kva. Trans. lighting
230 V. 3φ
Motors under 50 Hp.
Starting bus 1150 Volt
Disc. Sw.
Oil circuit brks.
Disc. Sw.
Sta. serv. main bus 2,300 V. Bus
Sta. serv. aux. bus
Sectionalizing Swit. (Future)
Clam shell
2,300 Volt motors (auxiliaries)
Ind. Draft motors
2,300 Volt motors (auxiliaries)
Fan, stoker, etc. Benjamin boiler cont.
250 Volt D.C. Power bus
500 Kw. M.G. Sets 714 Hp. Syn. motors
25,000 Kva. Turbo-gen. 13,900 V. 3φ 60~ 150 Kw. Shaft-end exciter
Emerg. Turb. (250 Kva. 2,300 V. 3φ 60~
3-8,333 Kva. Transformers 13,900/66,000 V. ΔY
3-1,250 Kva. Sta. serv. trans. 66,000/2,300 V.
Bank No. 1
Disc. Sw., Motor operated ground bus
Main bus, 66,000 Volt
Disc. Sw., Gang operated
Oil circuit breakers
Disc. Sw., Gang operated
Disc. Sw., Gang operated
Oil circuit breakers
Disc. Sw., Gang operated
Aux. bus, 66,000 Volt
Bank No. 2
Choke coil
Disc. Sw., Gang operated
Lightning arrester
Outgoing 66,000 V. feeders
Reactance

SINGLE-LINE WIRING DIAGRAM OF STATION AND OUTDOOR SUBSTATION

turbine room. The general layout differs in some respects from other large central stations in that there is no benchboard. The main switchboard consists of vertical panels installed in a straight line, this board ultimately to be about 35 ft. long. On this board are installed master switches and indicating lamps for controlling the generator breakers, turbine governors, generator rheostats and the indicating instruments such as generator ammeters, voltmeters, wattmeters, synchroscopes, synchronizing voltmeters and frequency meters. Testing terminals for checking and calibrating meters are mounted at the bottom of these panels. The relays and watt-hour meters are carried on a separate board 5 ft. behind the main board.

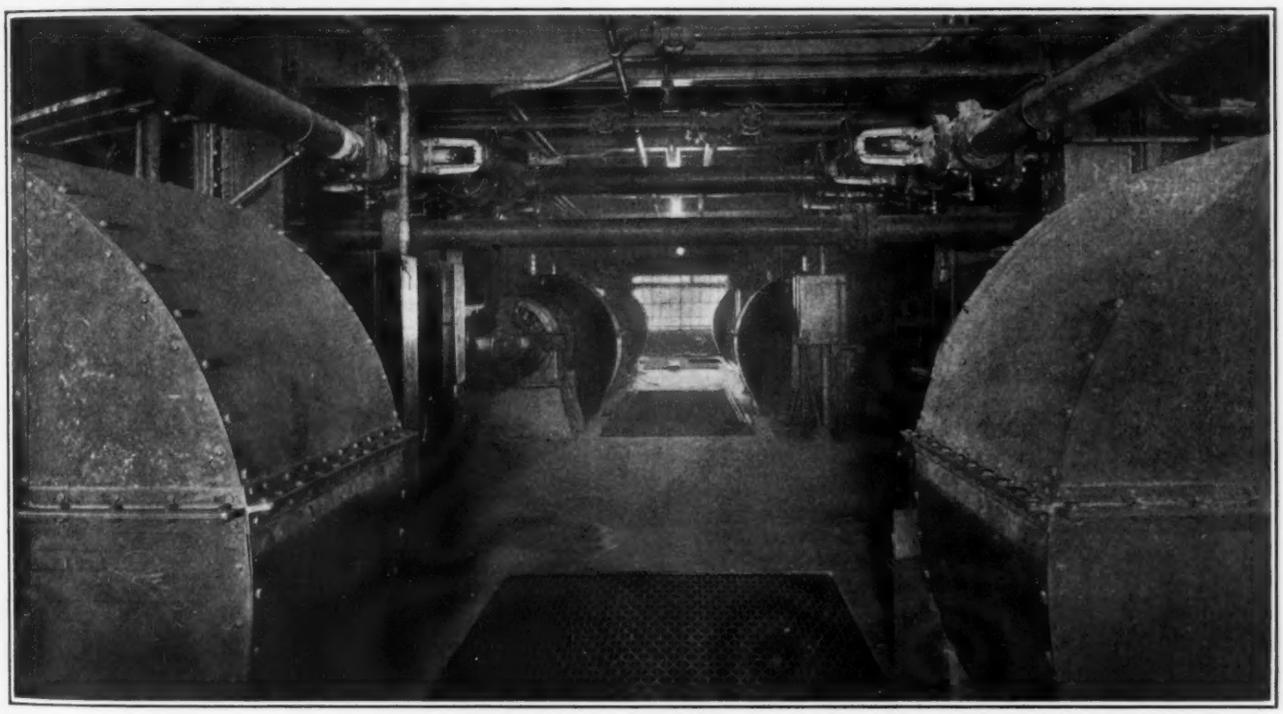
The feeder switchboard is very compact. The instruments and control switches for two circuits are mounted in vertical rows on each panel, the panels being but 20 in. wide. The generator panel width is 24 in. The main control panel requirements are unusually small for a plant of this capacity, because all the present and future circuits will be operated at 66,000 volts. Most of these circuits have a capacity of 25,000 kva. each.

The work of changing, testing and tracing control and instrument wiring is facilitated in this plant by the provision of a special control terminal room just below the main control room. Control and instrument circuits enter this room through conduit from all parts of the station and outdoor substation and are attached to terminal boards mounted on pipe framing. No joint or tap in the entire length of the control wiring is permitted. The wires occupy the same relative position on the terminal blocks, thus facilitating reconnecting and testing.

The 2,300-volt auxiliary station service buses and oil circuit breakers are installed in an electrical room between the turbine room and the boiler house, on the same elevation as the turbine-room basement. There are a main 2,300-volt and auxiliary 2,300-volt bus and an 1,150-volt starting bus. Each feeder is provided with a single oil circuit breaker and two sets of disconnecting switches, permitting operation on either 2,300-volt bus. In addition, each 2,300-volt motor circuit has an oil circuit breaker and a set of disconnecting switches on the 1,150-volt starting bus.

ESSENTIAL AUXILIARIES CONTINUOUSLY SUPPLIED WITH ENERGY

The normal method of operation of the station auxiliaries is as follows: The condenser auxiliaries and the station lighting are connected to the main 2,300-volt bus, the auxiliary turbine floating on this bus. The other auxiliaries, including the motor-generator sets supplying the 250-volt direct-current power service, are connected to the auxiliary 2,300-volt bus. The 3,750-kva. station service transformers are fed into the latter bus, and the two buses are operated in parallel through a tie breaker. The emergency turbine, when floating on the line, is energized to maintain 2,300 volts when the buses are separated. When so energized it acts as a synchronous condenser. The generator leads of the emergency turbine are equipped with a relay which opens the tie breaker whenever the turbine picks up full load.



FAN FLOOR BENEATH BOILER ROOM FIRING AISLE PROVIDES AMPLE CLEARANCES

All the 2,300-volt motors are provided with differential relay protection, so that the oil circuit breakers will be opened only under short-circuit conditions. No overload relay protection has been provided at this time, but studies now being made indicate that such relays may be installed later. The smaller motors supplied from the 230-volt station auxiliary bus are provided with overload and no-voltage protection.

The emergency station lighting, consisting of lamps over doorways and exits, is connected permanently to and supplied by the station control battery. Payne Dean station signal and load-indicating systems are provided. In conjunction with these systems there is furnished a full automatic intercommunicating telephone system of twelve stations ultimate capacity, nine now being

installed. This system is in no way connected with the outside telephone system. Those stations of prime importance, like the chief engineer or control-room operator's positions, use full twelve-point stations; those of lesser consequence, as in the top of the coal tower or coal-crusher house, are limited to six points.

As stated, the generators are designed to operate at 90 per cent power factor with no provision for automatic voltage regulation. This regulation is provided by large synchronous condensers at the load centers. These are equipped with automatic voltage regulators in order to maintain constant voltage at these points. These condensers serve the double purpose of maintaining good regulation and reducing losses in the transmission lines.

OUTGOING LINES FEED IMPORTANT CENTERS

In connection with the initial development at Devon a double-circuit, 66,000-volt steel-tower transmission line has been built from there to Derby, Waterbury, Southington, Meriden and New Britain, a total distance of about 50 miles. The power conductors are seven-strand No. 4/0 hard-drawn copper between Devon and Waterbury and No. 2/0 between Waterbury and New Britain. Another line, consisting of towers and flexible steel poles, has been built between Devon and Norwalk, about 22 miles. The power conductors consist of No. 2/0 steel-reinforced aluminum wire. Towers on these lines are of Blaw-Knox design, with Jeffery-Dewitt insulators. Each of these new lines has a No. 0 ground conductor of copper weld wire. While in the past private telephone lines have been carried on the transmission-line supports and while space has been left for such circuits on the new lines, these have been omitted at this time. Instead, the company is leasing circuits from the Southern New England Telephone Company. Most of these are in cable, giving additional insurance as compared with open-wire construction.

The general contractor for the Devon station was the J. A. P. Crisfield Contracting Company, a subsidiary of the U. G. I. Contracting Company, Philadelphia. The design and construction were carried out under the engineering supervision of Paul Spencer, consulting engineer, and K. M. Irwin, his mechanical engineering assistant; Irvin W. Day, vice-president, and E. J. Amberg, electrical engineer of the Connecticut Light & Power Company. C. F. Hirshfeld, Detroit, acted as advisory consulting engineer for the latter organization.

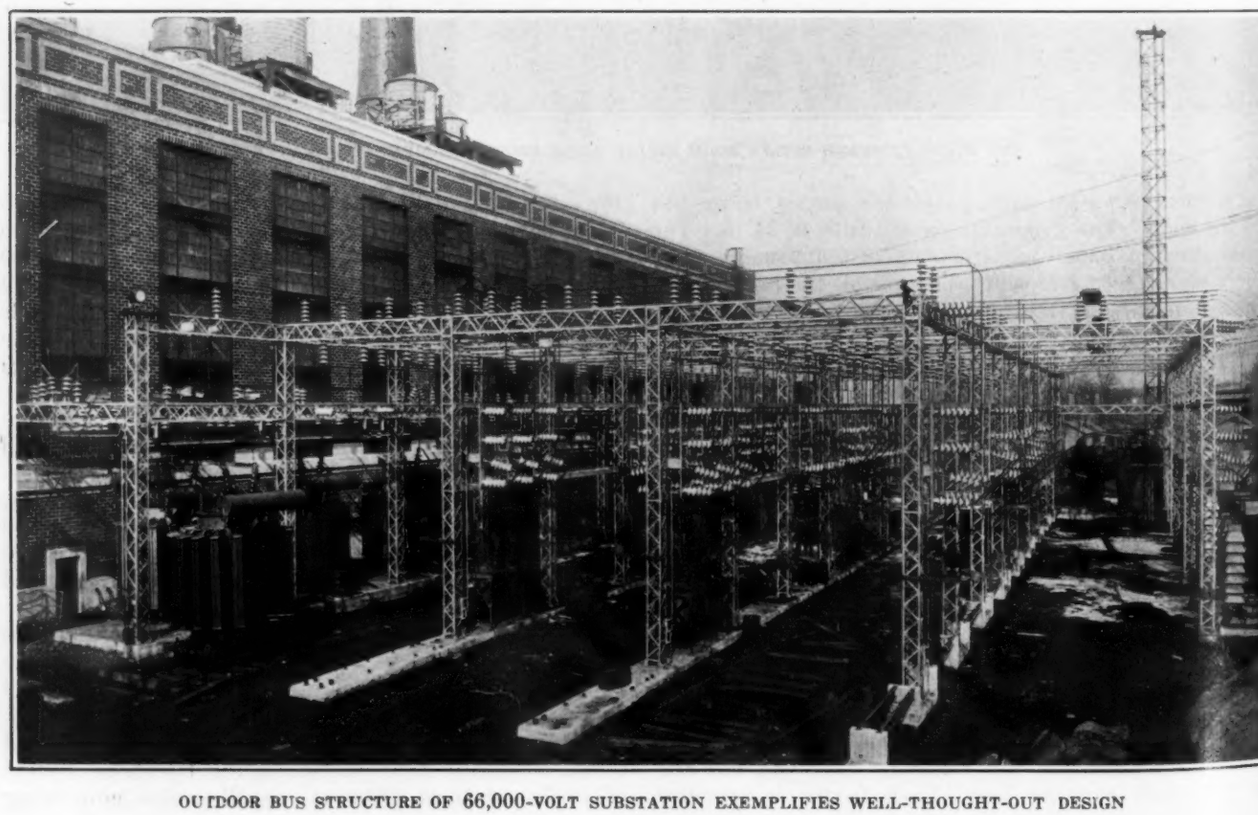
Swedish Electric Light and Power Statistics

THE Swedish Year Book for 1924 contains the following statistics in the electric light and power industry of Sweden as of the year 1921:

Number of works	752
Primary power used, in effective hp.:	
Water	1,020,889
Steam	272,917
Other power	36,412
Total	1,330,218
Power of generators installed, kw.	1,137,023
Energy produced, kw.-hr.	2,201,724,000
Energy received from outside sources, kw.-hr.	520,834,000
Energy delivered to other stations, kw.-hr.	555,569,000
Energy delivered to consumers (including that used for producers' purposes), kw.-hr.	1,826,358,000

The electrical energy distributed direct to consumers may be divided according to the uses to which it has been put as follows:

	Kw.-Hr.
Industrial	979,850,000
Electrolysis or smelting industries	351,272,000
Heating	174,475,000
Household or farming and small industries	249,473,000
Railways	58,938,000
Total	1,826,358,000



OUTDOOR BUS STRUCTURE OF 66,000-VOLT SUBSTATION EXEMPLIFIES WELL-THOUGHT-OUT DESIGN

Who Sells Electrical Appliances?—VI

A City of 800,000

"Electrical World" Survey of Retail Appliance Selling in a City Where the Central Station Does Not Merchandise But the Local Electrical League Is Popular and Active

MARKED differences in population, industries and general conditions affecting the sale of electrical appliances were found in this city as compared with the five previously surveyed. While the census gives the population as 800,000, a little more than one million people are reached by the lines of the central-station company. This population is made up of 66 per cent native-born whites, 30 per cent foreign-born and 4 per cent colored. The city's industries are widely diversified and have enjoyed their full share of the nation's prosperity of late years. As a result business has been good, people have had money to spend, and a fair amount of it has been put into electrical devices. Sales have been exceptionally good, which has led to the opening of a number of new electrical stores.

IN EACH of the five cities previously investigated, the local central-station company was an active merchandiser and its volume of sales ranged from 30.7 per cent to 41.2 per cent of the total in the different cities. The central-station company in the city described this week sells no appliances or lamps. Everything is left to the dealer. The effect of this policy on the relative sales by various classes of dealers is most interesting, particularly as concerns the amount and trend of business done by non-electrical dealers.

The city has one principal shopping and commercial district, while several other outlying communities have small commercial centers of their own. Electrical retailers are found scattered throughout the city, but those doing the principal volume of business are located in the main commercial center. The arcade type of building appears to be popular in this city, and many electrical stores have been established in such structures.

An electrical league is actively supported by the central-station company, electrical contractor-dealers, electric shops, jobbers, and manufacturers. Its membership is representative of the electrical fraternity in the city, nearly all of whom are subscribers. The purpose of the league has been to promote harmony, reduce unfair competition and conduct demonstrations and a general advertising campaign. It was almost the unanimous opinion of the electrical dealers that the league had been highly successful in all its promotional efforts.

The central-station company sells no electrical appliances whatsoever, nor does it maintain any showroom for demonstration purposes. It does, however, give considerable moral and financial support to the electrical league. The principal retail stores selling electrical appliances either as a part or all of their business are hardware stores, electrical contractor-dealers, electric shops, electric specialty and factory branch stores, department stores and housefurnishing stores.

The hardware dealers, as a class, do not handle the larger appliances, such as washing machines, vacuum cleaners or ironing machines. They do, however, sell all kinds of heating devices, as well as incandescent lamps, wiring supplies to a limited extent, and in some cases radio apparatus. There are a number of small stores doing considerable business on a cut-price basis. Their practices are much the same.

Store "A" was typical. Three standard makes of flatirons were carried and prominently displayed at prices about 25 per cent less than customary selling prices. Other electrical devices were also offered at reduced figures. For instance, an $8.50 electric heater was advertised for $5.98, a $6.50 toaster for $4.95, and a special $5 flatiron for $3.98. Questioned as to the reason for such prices, the proprietor said: "We have to meet the prices of others." Asked if he made money on this basis, he replied, "Well, we break even, anyhow." The discounts, he declared, permitted sales at such prices and allowed sufficient margin to cover overhead. Merchandise was purchased both from jobbers and direct from manufacturers, depending upon the prices offered. He asserted that one of the standard makes of flatirons which had been marked down 25 per cent from its well-advertised list price had been purchased direct from the manufacturer, who had never suggested that he should buy through a jobber at a lesser discount. The repairing of appliances was not a serious problem, as manufacturers so far had made good on defective parts and burn-outs. Minor repairs and cord trouble were taken care of right in the store.

Other hardware dealers corroborated these statements, particularly with reference to discounts—one declaring that he could obtain as good a price from the hardware jobber as he could from the electrical manufacturers and better than from electrical jobbers. Another dealer, who operates four stores, said that the policy of the local central-station company in refraining from merchandising had benefited other retail merchants. He also said that he believed the company had thus avoided a considerable expense in servicing appliances.

One store, "E" carries only the higher-priced appliances on which an attempt was being made to maintain list prices. The store has a fairly good location, but its total sales are about half those of the stores selling at the cut-rate prices. The consensus of opinion was that the hardware stores had profited by the central station's non-merchandising policy, that electrical devices are a permanent line for the hardware dealer and that sales may be expected to show a steady but moderate increase from year to year, depending to a very

considerable extent upon the degree of prosperity in the community.

The strictly electrical retail stores must be divided into three distinct classes—(1) contractor-dealers whose principal business is wiring and contracting work, with the sale of electrical appliances more or less incidental; (2) electric shops which do a general appliance business and also sell lighting fixture, portable lamps, etc., but do no wiring; (3) electric specialty or factory branch stores which specialize in the sale of washing machines and vacuum cleaners, with, in some cases, a few heating appliances used mostly for window-trimming purposes.

CONTRACTOR-DEALERS

This class of electrical store is located outside of the strictly commercial district. As will be noted from the tabulation, there is a wide difference in the volume of sales by individual contractors. In one instance the total annual appliance business does not exceed $500. Contractors H and I had very attractive showrooms with competent salesmen in attendance. They carried well-known makes of appliances only, and the larger devices were sold on the deferred-payment plan, the financing being done through a local finance corporation. A limited amount of direct by mail circularization was carried on, but no newspaper advertising was done by either of these concerns. On the larger devices, these dealers stated, the electrical stores specializing on particular items were getting most of the business. With outside selling crews, more advantageous locations and larger advertising appropriations, it was but natural that these stores should secure a much larger volume than was possible for the dealer whose electric appliance business was of secondary consideration.

The comments by contractor-dealer "P" were typical of this class. He keeps a very high-class store on the main street but considerably outside of the shopping center. His principal business is in the higher-priced and medium-priced lighting fixtures. Most of the showroom is devoted to displaying these fixtures, while appliances occupy space along one side of the room. Altogether his appliance sales are about 10 per cent of his total volume, but with some improvements which were being made he expects materially to increase this part of the business. He praised the electrical league for what it had accomplished and was of the opinion that the central-station company was following a shrewd policy in not selling appliances, principally because it avoided the servicing of appliances and also because it could disclaim responsibility for complaints of high bills from customers using energy-consuming devices. He did, however, criticise the company's sales policy in "overlooking bets" where it would be possible for it to increase the consumption of existing customers. That the electrical contractors and dealers benefited in increased sales because the central-station company had stayed out of merchandising he doubted, as much of this business had gone to hardware and department stores, and of recent years stores specializing in some of the larger appliances had sprung into existence. These stores he did not consider as real electrical dealers, nor did he approve of what he termed the high-pressure selling methods employed by some of the outside selling crews representing them. He thought that the contractor-dealer as a class was becoming a less important factor, and he saw no signs of the appliance business swinging back to him.

Other contractor-dealers expressed similar opinions, the consensus being that the larger appliances—washers, vacuum cleaners and ironing machines—were being sold chiefly by the specialty stores. The smaller devices represent such a small part of the contractors' business that they are considered incidental. None of the contractor-dealers seemed to expect any great increase in appliance business, but they maintained the line rather with a view to rounding out their stock.

ELECTRIC SHOPS

This type of dealer represents what might be termed the ideal electrical store. A general and complete line of electric appliances, portable lamps, some lighting fixtures and in two cases radio apparatus were carried in stock. All of these stores are in the main commercial area.

Shop "XA" moved into its present location on a prominent corner within the last year and the owner expressed his satisfaction with the advantages of the change. Three outside salesmen were maintained to follow up prospective sales which developed in the store and from newspaper and direct-by-mail advertising. Asked if he thought his sales would be as great if he did not have outside men, the owner said that fully half his sales were made by these salesmen at the customers' homes and that he considered them essential.

An interesting situation was recounted by the owner of shop "XB," which is also very well located in the shopping district. His appliance business has fallen off 75 per cent in the last year, and had it not been for a large volume of general supplies, incandescent lamps and radio sales he would have lost money. The appliance business, he said, was unsatisfactory because of the short discounts, and he believed that manufacturers were taking too much of the profit.

Shop "XC" is a typical arcade store and although a complete line of appliances is carried, washers represent 90 per cent of the gross sales. This dealer said that his business had not increased over last year and he had failed to derive any benefit from the Electrical League's advertising.

Dealer "XD" operates an electric shop apart from its contracting and fixture business. The manager was not overenthusiastic about the outlook for appliance sales. He believed that the electrical field was oversupplied with retail dealers. His appliance sales have fallen off about 50 per cent within the last year.

Referring to the central station's non-merchandising policy, he said that it had worked out fairly well for the company in permitting its escape from the servicing of appliances and complaints of high bills. It had not, however, thrown the business to straight electrical dealers. Because of their better and longer-established locations, the department, hardware, house-furnishing and specialty stores were taking advantage of the central station's absence from the appliance business, and were making most of the sales. Furthermore, no pioneer work was being done on new devices such as the refrigerator, range and dishwasher. None of the existing retail dealers, he pointed out, would or could spend the necessary money and effort and, so far, manufacturers had failed to take any hand in this work.

Shop "XE" also is located in one of the arcades. All sales are made from the floor, no outside selling force being employed. This, the owner admitted, has handicapped the shop in its washing machine sales. A considerable business in portable lamps, incandescent

and flashlamps went to make up a fair volume, but the owner hinted that he was considering either moving or selling out.

From these conditions it seems evident that as a class the electric shop with no outside salesmen has too limited a stock to make for a highly remunerative business. Only one of these stores appeared to be particularly prosperous. The others, while not exactly "struggling along," were not enjoying a flood of shoppers at any time. They were unable to concentrate sales and advertising effort upon the larger appliances, and the smaller devices did not bulk large enough to swell the total sales.

SPECIALTY STORES

All of the stores under this class depend upon washing-machine or vacuum-cleaner sales or both, which represent 71.6 and 22.6 per cent respectively of the total volume. Some may be classed as factory branch stores and others are agencies, while a few carry several makes of machines. Heating appliances when stocked are mostly for window-dressing purposes.

Store "XF" sells three makes of washers and employs two salesmen-demonstrators who take machines out for trial, closing the sale at the customer's home. This store is well located in one of the arcade buildings, and nearly all leads have been secured through people coming in and by advertising, which had frequently taken the form of offering a special price for one or two days. The manager said that he would rather meet price competition through advertising a reduced price than by special inducements to individuals. He approved of the central station's non-merchandising policy as it left

SALES OF PRINCIPAL ELECTRICAL APPLIANCES, SHOWING QUANTITY, VALUE AND PROPORTION SOLD BY HARDWARE STORES DEPARTMENT STORES, ELECTRICAL DEALERS AND OTHER RETAIL OUTLETS

Kind of Dealer	Washing Machines	Vacuum Cleaners	Ironers	Flatirons	Curling Irons	Toasters	Percolators	Total Sales Each Class of Store	Per Cent of Total for City
Hardware Stores									
Store "A"	.....	.....	.....	900	800	200	100		
Store "B" (two stores)	.....	.....	.....	1,000	1,000	200	150		
Store "C" (four stores)	.....	.....	.....	2,800	1,800	350	225		
Store "D"	.....	.....	.....	750	500	125	60		
Store "E"	.....	.....	.....	500	600	140	50		
Store "F"	.....	.....	.....	800	750	175	35		
Total	.....	.....	.....	6,750	5,450	1,190	620		
Value	.....	.....	.....	$40,500	$24,650	$7,140	$7,440	$79,730	2.5
Per cent of electric appliance sales	.....	.....	.....	50.8	30.9	8.9	9.4		
Contractor-Dealers									
Dealer "G"	5	8	4	25	36	18	6		
Dealer "H"	30	12	2	48	24	20	10		
Dealer "I"	31	80	.....	150	75	24	12		
Dealer "J"	25	40	.....	36	30	78	6		
Dealer "K"	9	4	.....	50	36	12	8		
Dealer "L"	20	18	3	75	48	15	6		
Dealer "M"	6	18	1	30	25	20	9		
Dealer "N"	.....	20	.....	36	30	18	6		
Dealer "O"	18	20	10	75	60	24	10		
Dealer "P"	100	25	2	125	75	36	18		
Dealer "Q"	20	30	4	48	36	18	6		
Dealer "R"	10	3	4	50	40	20	8		
Dealer "S"	3	4	1	36	24	18	.....		
Dealer "T"	2	.....	.....	24	12	10	4		
Dealer "U"	36	100	5	100	75	36	12		
Dealer "V"	25	20	.....	60	48	20	10		
Dealer "W" 10 miscellaneous dealers	150	75	8	250	300	75	36		
Total	490	477	44	1,218	974	406	167		
Value	$61,250	$25,042	$6,600	$7,308	$4,383	$2,436	$2,004	$109,023	3.5
Per cent of electric appliance sales	56.2	23.0	6.1	6.7	4.0	2.2	1.8		
Electric Shops									
Shop "XA"	750	300	125	1,000	750	350	125		
Shop "XB"	.....	25	.....	500	450	125	36		
Shop "XC"	800	50	25	60	36	30	25		
Shop "XD"	250	60	.....	350	225	100	60		
Shop "XE"	250	200	.....	500	450	225	125		
Total	$1,950	635	150	2,410	1,911	830	371		
Value	$243,750	$33,337	$22,500	$14,460	$8,599	$4,980	$4,452	$332,078	10.6
Per cent of electric applicance sales	73.4	10.1	6.8	4.3	2.6	1.5	1.3		
Specialty Stores									
Store "XF"	800	75	18	50	25	24	18		
Store "XG"*	1,131	2,590	150	.....	.....	.....	.....		
Store "XH"	850	.....	.....	.....	.....	.....	.....		
Store "XI"*	1,300	.....	.....	.....	.....	.....	.....		
Store "XJ"*	1,550	625	220	75	30	21	15		
Store "XK"	750	.....	.....	.....	.....	.....	.....		
Store "XL"*	1,200	600	115	.....	.....	.....	.....		
Store "XM"	1,000	500	75	.....	.....	.....	.....		
Store "XN"	.....	2,100	.....	.....	.....	.....	.....		
Total	8,581	6,490	568	125	55	48	33		
Value	$1,072,625	$340,725	$85,200	$750	$247	$288	$396	$1,500,231	48.0
Per cent of electric appliance sales	71.6	22.6	5.7	0.05	0.01	0.02	0.02		
Department Stores									
Store "DA"	650	850	.....	2,400	3,000	750	200		
Store "DB"	1,500	2,500	18	3,300	3,500	950	400		
Store "DD"	700	950	.....	1,500	2,000	550	250		
Store "DC"	850	1,200	30	2,000	1,800	400	175		
Store "DE"	400	675	.....	1,200	1,500	500	200		
Total	4,100	6,175	48	10,700	11,800	3,150	1,225		
Value	$512,500	$324,187	$7,200	$64,200	$53,100	$18,900	$14,700	$994,787	31.8
Per cent of electric appliance sales	51.5	32.6	0.7	6.5	5.3	1.9	1.5		
Housefurnishing Stores									
Store "Y"	200	325	12	350	150	100	48		
Store "Z"	250	500	15	500	.....	250	75		
Total	450	825	27	850	150	350	123		
Value	$56,250	$43,312	$4,050	$5,100	$675	$2,100	$1,476	$112,963	3.6
Per cent of electric appliance sales	49.8	38.4	3.5	4.6	0.6	1.8	1.3		
Central Station Company (does not sell appliances)									0.0
Grand Total									
All dealers	15,571	14,602	837	22,053	20,340	5,974	2,539		
Value	$1,946,375	$766,603	$125,550	$132,318	$91,654	$35,844	$30,468	$3,128,812	100.0
Per cent of total sales	62.3	24.5	4.0	4.3	2.9	1.1	0.9		

* Factory branch stores.

the field open, but he also observed that the department stores were cutting in on the business.

Specialty dealer "XG" occupies an interesting position in that the sales manager is in charge not only of city sales but also of quite a territory in surrounding states. He declared that the reason for the small electric dealer not selling more of the large appliances was his lack of money to finance extended payments in competition with department stores which offered twelve to eighteen months and even longer to pay for machines without added interest. Furthermore, many of the small electrical dealers were not desirable representatives for the large appliances because of doubtful credit standing. They also pay more attention to their wiring and fixture business than to pushing the sale of electrical merchandise. Large-volume business on the higher-priced devices, this manager said, could be accomplished only through an adequate sales crew in the field. "Man-power" he declared to be the answer. The company endeavors to secure dealer representation and operates on a resale plan. In order of preference the classes of retailers wanted are central-station companies, department stores, furniture houses, hardware stores and lastly electrical contractor-dealers. Future retail sales of larger appliances, he predicted, will be handled to a great extent by the manufacturers themselves operating through some dealer agency under resale plans directed by the company's organizers.

Store "XJ" is established in the most frequented of the arcade buildings and carries a general line of appliances, but the sales of the smaller devices are insignificant. It was a factory branch store.

Other specialty stores had but little to offer in the way of original opinions. All complained more or less of the keen competition from other dealers, and the questions of taking in second-hand machines, price cutting and the department stores' policy were uppermost in their minds. Nearly all were of the opinion that they were benefited by the central-station company's remaining out of the merchandising business, but, on the other hand, they were not particularly interested in any electrical activities excepting their own sales.

The branch manager of a well-known household device, which is sold almost altogether upon the resale plan, declared that the use of outside selling crews will continue, but he deplored the practice of some manufacturers in operating salesmen on the basis of quantity and not quality. The use of man-power without discrimination or careful direction is having a bad effect upon the public mind and will in the end react upon the dealer or manufacturer. He did not believe that electrical dealers in this city had benefited through the central station's non-merchandising policy.

DEPARTMENT STORES

All department stores handle electrical appliances to a greater or less degree, but five are listed whose total sales are important. Department store "DA" does a cash business except on its sales of larger devices. The department manager stated that the electrical sales had increased rapidly during the last two years and that all electrical devices would soon be put in a separate department on the house-furnishing goods floor. He considered the line as permanent and expects to see it grow steadily from year to year.

Department store "DB" is the largest in the city, catering to a medium-priced trade. There is no separate department for the sale of electrical merchandise; in fact, it was found displayed on four different floors. Questioned as to the permanence of this merchandise in the department store, the manager replied: "Most certainly; everything is electrical now, isn't it?" The policy of every department store, he pointed out, was to carry any kind of merchandise for which there was a demand. Asked as to the store's practice on maintaining prices the manager denied selling below list, but later admitted that at times they had advertised flatirons as leaders at a reduced price.

Of the three other department stores none has a strictly electrical department. Washing machines usually are carried in the basement or else in the house-furnishing department, and one store had a particularly attractive display of small devices on the ground floor next to its silverware department. Prices appeared to be fairly well maintained and the appliances carried were generally of well-known standard makes. All stores, however, had in stock some cheaper devices, and curling irons in particular had been sold at very low prices. From time to time the advertising of these stores features the larger appliances, and one store stated that in a two-week drive on washing machines sales had averaged twenty machines per day.

HOUSEFURNISHING STORES

There are two large, well-appointed housefurnishing stores which handle electrical merchandise. Neither employs an outside selling force, but both have men directly in charge of electrical appliance sales and servicing. Store "Y" stated that its appliance sales had been increasing approximately 15 per cent per year. Servicing was not a serious problem, and the store had no inclination to discontinue the line. Purchases were made mostly direct from the manufacturers.

Store "Z" is primarily a furniture and interior decorating concern and its principal electrical line is high-grade portable and floor lamps. Electrical appliances are carried because it is felt that they have a logical place in the business. It is interesting to note that this store's portable-lamp business amounts to between $300,000 and $400,000 annually. A very large stock of this class of merchandise is carried, and incidentally the store manager said that a margin of at least 50 per cent was necessary. The manager also declared that in his opinion there should be a little wider margin of profit on electrical appliances, and he believed they were in some instances priced too high.

He approved the policy of the central-station company in not merchandising and emphasized the fact that the company could disclaim responsibility for high bills caused by the energy consumption of large devices.

The local central-station company discontinued merchandising electrical appliances some twelve years ago. As noted at the outset, it is giving active support to the local electrical league through financial contributions and also loaning the services of company employees to the activities of the league. The company feels that the sale of electric appliances is being satisfactorily conducted by the various classes of dealers now engaged in the business.

CONCLUSIONS

With the central-station company out of the merchandising field in this city, the relative importance of the other electrical dealers presents a striking difference when compared with other cities investigated. Total appliance sales may be divided on the following basis: Hardware stores, 2.5 per cent; contractor-dealers, 3.5 per cent; electric shops, 10.6 per cent; electric

specialty stores, 48 per cent; department stores, 31.8 per cent; housefurnishing stores, 3.6 per cent. It is significant to note that the combined sales of electrical contractor-dealers and electric shops amount to only 14.1 per cent of the total for the city. The major portion of the business, 79.9 per cent, is being done by the specialty and department stores. It is even more significant to note that the washing-machine sales by the specialty stores amount to a little more than one-third of the total sales of all appliances by all dealers in the city. Heating-device sales are largely in the hands of the hardware and department stores, while the straight electric dealer views this business almost with contempt.

Department and housefurnishing stores are increasing their business. Hardware stores likewise are satisfied with the increases in their sales of heating devices. Contractor-dealers state that they do not expect any more than to hold their own from year to year in appliance sales and some reported a decrease for 1923.

Some of the specialty stores have been on the anxious bench financially of late, and there seems to be a general sentiment that some will drop by the wayside and others may consolidate. The electric shop is the most difficult to analyze. To be successful they require exceptionally good locations, capable management and aggressive advertising and sales effort. Sales by such shops in this city represent 10.6 per cent of the total, and it does not seem likely that they can improve their position in the face of competition from the hardware, department and housefurnishing stores.

THE TREND

Present signs indicate that under existing conditions, with the non-merchandising policy of the central station, the appliance business is gradually drifting to the hardware, department and housefurnishing stores and they may be expected to do 50 per cent of the city's business within the next three years. These three stores are now selling 37.9 per cent of the appliances. The number of specialty stores and their volume of sales will probably decrease. It is evident from reports of all classes that the activities of the local electrical league have been very beneficial as a general stimulant to sales. It is also evident that the electrical dealers have not actually enjoyed greatly increased appliance sales as a result of the central station's abandoning the sales of appliances. Their principal benefits have been realized in contracting and fixture sales. One of the executives of the electrical league stated that recent figures published showing increases of from 50 to 100 per cent in the appliance sales by some dealers for 1923 should not be taken as an index for the entire city. He doubted very much if the total sales would show an increase of 40 per cent over the previous year. As a matter of fact, from all reliable figures upon which a comparison could be made a 25 per cent increase would be about the proper estimate.

Pioneering work on new apparatus is not being done by any one. Although considerable money is spent for advertising purposes, the direct sales effort which is necessary to put these appliances in use is not being made, and therefore sales are virtually nil.

It also seems to be a fact, from the statements of non-electrical dealers, that they can obtain discounts as good as, if not better than, those quoted to the bona fide electrical dealer. This is not always due to their buying in large quantities, but rather they seem to be favored by the manufacturers.

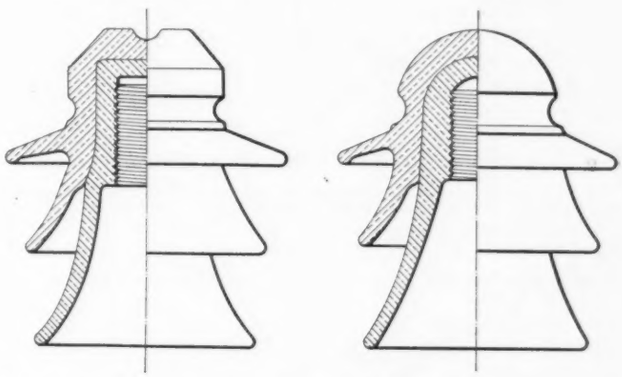
Improvements in Insulators

Breakdowns Obviated by Employing Binder Which Fills All Pores and Renders the Cemented Joints Impervious to Moisture

BY DR. E. ROSENTHAL
A.E.G.-Rosenthal Porcelain Factory, Berlin-Hennigsdorf

THE problem of the "broken insulator" has during the past few years been the subject of intensive research. Distribution troubles due to the failures of insulators led to unreliability of service and cast suspicion not only on the insulators themselves, but also on porcelain as an insulating material. This has been a cause of much concern not only to porcelain manufacturers but to the users of insulators also. Both are compelled to study the nature of the faults in a thorough manner.

The cause of much of the disturbances was traced to the layer of cement between the petticoats of the insulator. This, it was found, possesses a larger coefficient of expansion than porcelain (nearly four times as large). Moreover, the smooth binding surface and sharp heads of the porcelain pieces gave rise to stresses which were not taken up uniformly, the expanding cement concentrating its force at a single point on the porcelain in the direction of the upper binding layer, and consequently rupture of the outer parts of the porcelain could not be averted.



FIGS. 1 AND 2—OLD AND NEW FORMATION AND ARRANGEMENT OF INSULATOR PETTICOATS

By rounding off the joints so as to give the upper-end surfaces of the insulators a hemispherical shape and consequently also the binding layer, the pressure due to heat expansion was uniformly distributed over the outer porcelain parts, thereby eliminating undue pressure intensities on the surface. By this means the percentage breakdown of cemented joints was considerably reduced.

A further improvement was made by choosing a binding material having the same degree of expansion as porcelain. For this purpose foreign materials were added to the cement which reacted with the cement and which themselves possessed a small coefficient of expansion so that the degree of expansion of the combined binding material approached that of porcelain. Notwithstanding the use of such a binder, however, it was discovered that insulators made with it were not exempt from faults arising from failure of the joints. Failures occurred in insulators after they had been in service from three to four years.

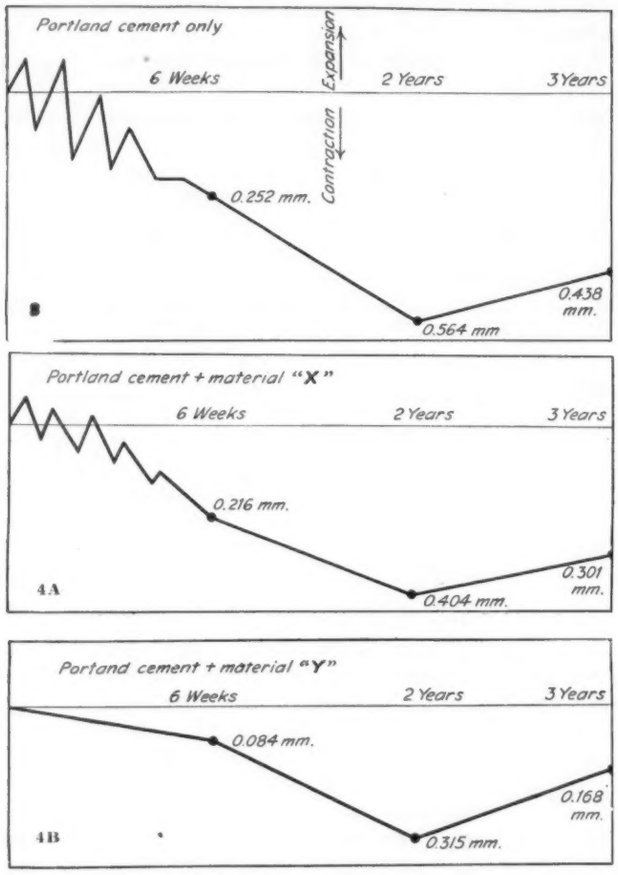
To discover the causes of these failures exhaustive

and systematic scientific investigations were begun four years ago by the Porzellanfabrik Ph. Rosenthal & Company, A. G., in collaboration with the Material Prüfungsamt in Dresden. These investigations, which have just been completed, show that cement contracts during the process of setting and that this contraction continues unabated during a period of from two or three years until the cement at last reaches its final degree of hardness. Even after the cement has fully set and has become "stone," it was discovered that it is still capable of absorbing moisture from the atmosphere and increasing in volume. Owing to the combined effects of expansion due to heat and of the absorption of moisture, the hardened cement tends to occupy a larger volume than it did originally. Severe stresses were set up in the insulators leading to their failure, despite the fact that the heat-expansion coefficient of the cement is the same as that of porcelain.

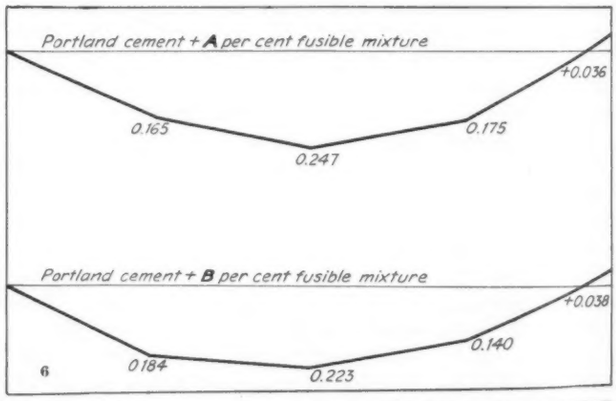
Figs. 3 and 4 show the nature of the contraction characteristics of cements with and without the admixture of foreign substances under the same conditions of temperature. From these it will be observed that as the cement hardens in the course of years it also contracts. Figs. 5 and 6 show how the combined effects of contraction during hardening and of expansion due to heat increase the length of a block of cement over and above its original length.

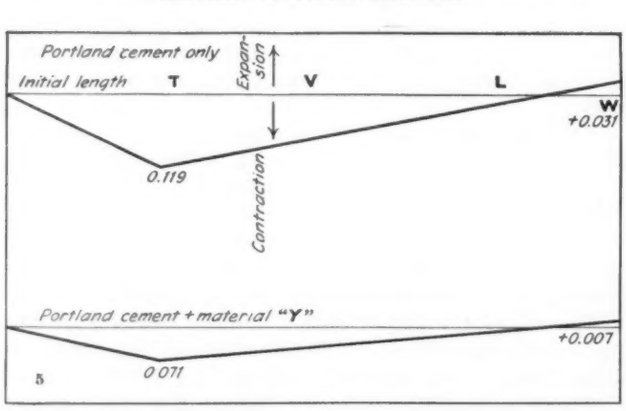
In order to prevent an increase in volume of the cement caused by the absorption of moisture, a pitch flux was added to the cement before it was worked up. An insulator put together with such a binder was then heated and maintained at a temperature of 90 deg. C. for a considerable length of time so as to shorten artificially the hardening process. This temperature was chosen as being just below the temperature of fusion of the flux. Although the cement is thereby completely hardened, heat is applied until the flux begins to melt and the pores of the cement are filled up. When the insulator cools, this pitchy or tarry matter renders the cement binder impervious to water, so that any increase in volume due to absorption of moisture is rendered impossible.

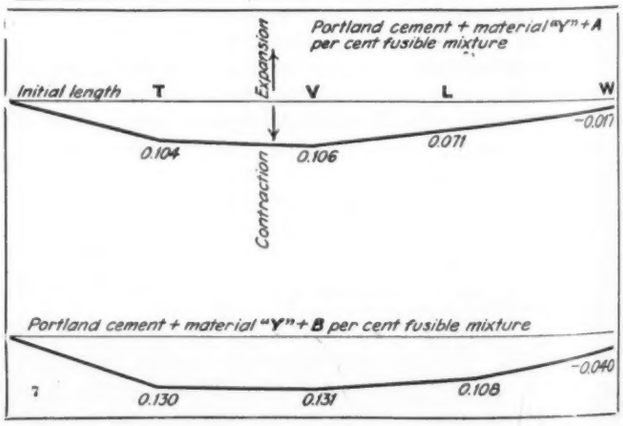
It might be felt that the addition of the flux to the cement would detract from its mechanical strength, but tests have demonstrated that not only is the strength of the cement not impaired but it is even increased. Fig. 7 shows that the liability of the cement to absorb moisture is eliminated and also that the volume of the cement with the mixture of pitch at correspondingly equal temperatures is no greater than the volume of the cement alone.



FIGS. 3 AND 4—CONTRACTION OF CEMENT WITH AND WITHOUT ADDITION OF OTHER MATERIAL







FIGS. 5, 6 AND 7—CHANGES IN LENGTH OF CEMENT USED BETWEEN PETTICOATS OF INSULATORS
Changes when heated to 105 deg. C. (*T*), 140 deg. C. (*V*) and during subsequent storage (*L*), after treatment with water to saturation under vacuum, are shown

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Fundamentals of Safe Electrical Construction

To the Editors of the ELECTRICAL WORLD:

At the recent annual meeting of the Wisconsin Chapter of Electrical Inspectors at Eau Claire, Wis., I made the statement that I cannot escape the conclusion that the best electrical code would be a code in which the end to be attained is specified in broad terms rather than the specific means to be adopted. This would place the fewest obstructions in the path of progress and would enable us to adopt a code which with little change would meet the requirements for all time. However, all men are not possessed of equally good judgment, and therefore the ideal form of code is not practical, because the construction that may appear to some men to satisfy all safety requirements may not be satisfactory in experience. While the practical code must square with the fundamental principles of safety, it must go more or less into the details of the methods of construction to be followed in insuring safety, with the result in many instances of obscuring the reason back of a rule, unless the intent can be discerned through knowledge of these fundamentals. With these as my reasons, I therefore set forth what I conceive to be the fundamental features of electrical construction which reduces to a minimum the life and fire hazard.

1. Not only is it necessary that conductors have adequate conductivity for the current to be transmitted, but there must be assurances that this limited current will not be exceeded under any circumstances. Thus wiring systems must be fully protected by fuses or circuit breakers against overload and short circuit.

2. Parts at different potentials must be properly insulated from one another. When air is the insulating medium great care must be exercised to insure and maintain adequate spacing between such parts. In the case of insulated wires too much dependence should not be placed upon the insulating cover, which usually is not mechanically strong. Hence such wires should be properly spaced from each other, and where this is not possible other means should be adopted to maintain good insulation.

3. While the minimum voltage that will cause death to human beings does not seem to be a definitely determined quantity, it is known to be low. Experiments by the Bureau of Standards indicate that it is not safe to pass more than 25 milliamperes through any part of the body in which vital organs are situated and that 100 milliamperes will suspend animation. According to the Bureau of Standards, the resistance of the body exclusive of the contact and skin resistance is only 200 ohms from hand to hand. Hence it can be appreciated that if the skin resistance is broken down, there is little to hinder a flow of current that will be fatal. For these reasons it may be said that all commercial voltage must be considered as dangerous and that therefore we must guard or inclose all parts at a potential above ground of 100 volts. Moreover, something must be done to prevent the entrance of high voltage into buildings over the low-voltage service wires, because, although the low-voltage equipment may be properly guarded or inclosed, its insulation may not be sufficient to protect the user from such high voltages. Exclusion of the high voltages from buildings can best be accomplished by permanently and effectively grounding the secondary system as required by the code.

4. While guarding the live parts has thus far been discussed only from the standpoint of safety to life, it must be pointed out that exposed live parts at different potentials constitute a fire hazard. Arcing and sparking can take place in a variety of ways, and if parts are not inclosed, adjacent inflammable materials will be ignited. Moreover, in atmosphere laden with inflammable gases and flying particles, serious explosions will be caused by arcing and sparking unless the parts are inclosed in explosion-proof cases.

5. Inclosures, to remove the fire hazard effectively, must, of course, be made of non-combustible material, which usually means metal. Such metal inclosures may at times become alive through the failure of the insulation of the inclosed live parts. For this reason it has long been a requirement that all non-current-carrying metal parts shall be permanently and effectively grounded through water-pipe or adequate artificial grounds.

JOHN A. HOEVELER,
Electrical Engineer.
Industrial Commission of Wisconsin,
Madison, Wis.

Nomenclature of Harmonics in Polyphase System

To the Editors of the ELECTRICAL WORLD:

Prof. Karapetoff's interesting letter published in the ELECTRICAL WORLD for February 2 suggests a few comments on the nomenclature of harmonics in polyphase systems.

The suggestion of "triplen" and "non-triplen" seems excellent and provides a definite substitute for abbreviations that we have used for several years in discussing problems of inductive co-ordination; that is, often using the phrases "triple harmonics" and non-triple harmonics" to indicate the whole series and abbreviating by leaving out the word "harmonics." The abbreviation "3n" makes very convenient shorthand. The suggestion of such terms as "uniphase" and "three-phase" or "polyphase" also seems good. As is doubtless well known, the expressions "residual" and "balanced" have been used for some years to provide this distinction.

To express the opposite phase sequence of the two groups of "non-triplen," I suggest consideration of the words "normal" and "reversed," depending on whether the phase sequence is like that of the fundamental or unlike it. The words "normal" and "reversed" have been used for a number of years in a somewhat similar application to indicate the direction of rotation of a transposition in a power circuit, the "normal" in that case being simply the standard direction used on the particular line.

The even harmonics which are occasionally met with are easily provided for in Professor Karapetoff's scheme, when necessary, by the expression "even triplen," as distinguished from "odd triplen"—and likewise for the "non-triples." There are cases where, as in the magnetizing current of T-connected three-phase transformers, one finds "polyphase" or "balanced" triplen. Residual, or uniphase, non-triplen often occur in polyphase systems.

I feel that Professor Karapetoff's suggestion is practical and helpful, and, with the addition of terms for the other distinctions, will make discussion simpler.

D. I. CONE,
Protection Engineer.
Pacific Telephone & Telegraph Company,
San Francisco, Cal.

Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

Grounding Conductors for Protective Purposes

By Ralph Brown
Great Western Power Company, Caribou, Cal.

Because of the possibility of a dangerous potential being induced from the atmosphere or from parallel conductors in overhead transmission lines that are not grounded, as well as the risk of such conductors coming in contact with an energized line, protective grounding of overhead circuits is generally recognized as an essential safety precaution when men are to work on the circuit or on any connected equipment.

While the practice of grounding high-voltage conductors is nearly universal, there appears to be some doubt as to the necessity of grounding circuits operated at less than 22 kv. Consequently work is sometimes done on low-voltage and medium-voltage circuits that are not grounded. Such a practice is not justified. The greatest safety to equipment and workmen is insured when any circuit operated at 250 volts or above is effectively grounded and short-circuited before being touched.

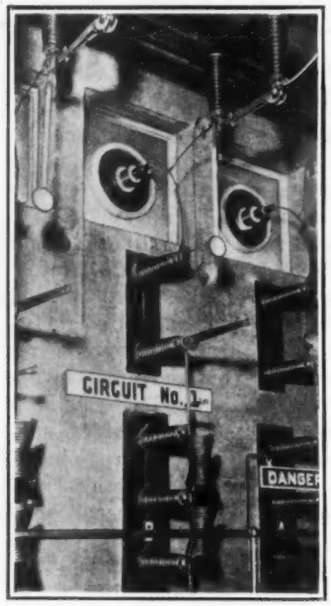
A rather common method of grounding is to earth the end of a copper-plated steel chain and to wrap the chain loosely about each of the de-energized conductors. This method is certainly not effective when applied to a circuit over which a very heavy current will flow if short-circuited, since under such conditions the chain would probably be melted, it merely acting as a fuse and possibly causing damage to the line conductors by arcing. A chain or a very small wire is sufficient to maintain a de-energized conductor at ground potential as long as only a small current can flow. To be really effective, however, the ampere capacity of a grounding and short-circuiting device should be either great enough to carry safely the short-circuit current until the relays can disconnect the circuit or greater than that of the circuit.

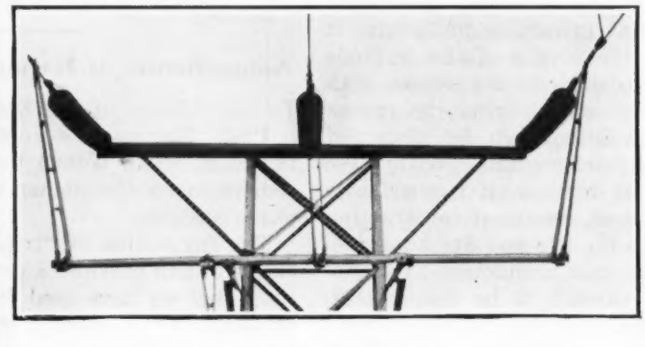
While safety rules are devised and precautions are taken to prevent connecting a grounded and short-circuited line to a source of power, such an accident nevertheless may occur, and it is for this reason that the grounding device must be capable of withstanding the effects of the possible short-circuit current for a brief period.

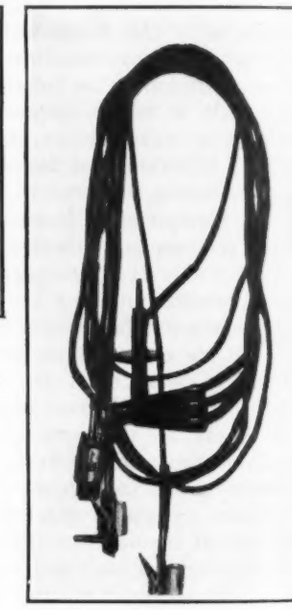
A grounding and short-circuiting device applied to a 132-kv. circuit is shown in Fig. 2. The three grounding blades are clamped to a steel shaft supported in grease-lubricated bearings that are attached to the steel structure. Each clip is connected through a flexible copper cable to the station ground conductor. An operating lever, not shown, is placed near the base of the structure and is connected to the shaft through a steel rod attached to a string of suspension type insulators. This grounding device is simple and effective and with modifications can be used on lines of any voltage and ampere capacity. Provision is made for locking the device when in either the open position or in contact with conductors.

A method of grounding a 70-kv. circuit is illustrated in Fig. 1. A ground bus is used, and the circuit is grounded by closing the three upper disconnecting switches. The lower disconnects are required for insulating the oil switch and cannot be closed while the grounding disconnectors are closed, because of the circular fiber targets that then cover the upper clips of the lower group of switches.

The grounding device shown in







METHOD OF GROUNDING HIGH-VOLTAGE CIRCUITS

Fig. 1 (Left)—Method of grounding 70-kv. circuit by closing disconnecting switches. As a ground bus is used, the circuit is grounded by closing the three upper disconnecting switches.

Fig. 2 (Center)—Grounding and short-circuiting device applied to 132-kv. circuit. Each grounding blade is clamped to the steel shaft, which is operated by a lever at the ground.

Fig. 3 (Right)—Portable grounding equipment consisting of three extra-heavy spring clamps attached to insulated copper cables.

Fig. 2 is to be preferred to the use of disconnecting switches, but either of these methods is superior to grounding by means of a chain or cable.

A portable grounding device that has proved useful where permanent devices have not been installed is shown in Fig. 3. It consists of three extra-heavy spring clamps attached to insulated copper cables, the longest cable terminating in a bayonet-type plug. Grounded receptacles are placed in the switch rooms and bus rooms for the insertion of the cable plug.

This grounding device is very much better than a grounding chain, but the clamps and cables become objectionably heavy when a path for very severe short-circuit currents must be provided. No portable grounding device can be equipped with a safety interlock. As much time and labor must be expended to apply and remove them, the application of portable grounding devices should be limited to short sections of transmission lines or other cases where the installation of a permanent device is not economically justified.

A permanent grounding device to be most effective should be operated by movement of a lever. A reliable mechanical interlock should be provided to make it impossible to ground a circuit until after the oil switch and disconnecting switches have been opened, or to close the disconnects and oil switch while the circuit is grounded. Since it is difficult to install permanent grounding devices in stations that are completed, it is evident that provision for such devices should be included in the plans, if the best practices in protective grounding high-voltage lines are to be followed.

Correcting Power Factor

BY GEORGE W. QUENTIN
Contract Department Duquesne Light Company, Pittsburgh, Pa.

FOR correcting inductive load by means of static or synchronous condensers the accompanying table has been found convenient. The figures in the table multiplied by the kilowatt load will give the condenser capacity necessary for raising the power factor from one value to another. Suppose it is desired to increase the power factor of a system using 600 kw. at 60 per cent lagging to a power factor of 80 per cent lagging. From "Initial Power Factor" column at 60 per cent read horizontally across the "Final Power Factor" column at 80 per cent, or 0.583. The condenser for this correction is secured by multiplying 0.583 by 600, which equals 350 kva.

As another example, suppose the initial power factor of this system to be 45 per cent lagging and that it is desirable to increase it to 92 per ment lagging. The total corrective capacity required to increase this from 45 per cent to 100 per cent is 1.984. The corrective capacity required from 92 per cent to 100 per cent is 0.426. The final desired correction from 45 per cent to 92 per cent would, therefore, be $(1.984 - 0.426) \times 600 = 935$ kva.

POWER-FACTOR CORRECTION FOR INDUCTIVE LOADS BY USING CONDENSERS

The figures multiplied by the kilowatt load give the necessary condenser kva. for correction from one power factor to another.

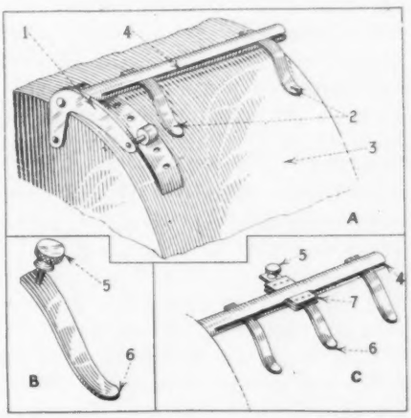
Initial Power Factor, per Cent	Final Power Factor, per Cent				Initial Power Factor, per Cent	Final Power Factor, per Cent			
	100	95	90	80		100	95	90	80
40	2.291	1.962	1.806	1.541	70	1.020	0.692	0.536	0.270
41	2.225	1.897	1.741	1.475	71	0.991	0.763	0.507	0.241
42	2.160	1.832	1.676	1.410	72	0.964	0.636	0.480	0.214
43	2.099	1.771	1.615	1.349	73	0.936	0.608	0.452	0.186
44	2.041	1.713	1.537	1.291	74	0.908	0.580	0.424	0.158
45	1.984	1.656	1.500	1.234	75	0.882	0.554	0.398	0.132
46	1.930	1.602	1.440	1.180	76	0.855	0.527	0.371	0.105
47	1.878	1.550	1.394	1.128	77	0.828	0.500	0.344	0.078
48	1.827	1.499	1.343	1.077	78	0.802	0.474	0.318	0.052
49	1.779	1.451	1.295	1.029	79	0.776	0.448	0.292	0.026
50	1.732	1.404	1.248	0.982	80	0.750	0.422	0.266	.....
51	1.686	1.358	1.202	0.936	81	0.723	0.395	0.239	.....
52	1.642	1.314	1.158	0.892	82	0.698	0.370	0.214	.....
53	1.600	1.272	1.116	0.850	83	0.671	0.343	0.187	.....
54	1.558	1.230	1.074	0.808	84	0.646	0.318	0.162	.....
55	1.518	1.190	1.034	0.768	85	0.619	0.291	0.135	.....
56	1.479	1.151	0.995	0.729	86	0.593	0.265	0.109	.....
57	1.441	1.115	0.957	0.691	87	0.566	0.238	0.082	.....
58	1.404	1.076	0.920	0.654	88	0.539	0.211	0.055	.....
59	1.368	1.040	0.884	0.618	89	0.512	0.184	0.028	.....
60	1.333	1.005	0.849	0.583	90	0.484	0.156	.....	.....
61	1.298	0.970	0.814	0.548	91	0.455	0.127	.....	.....
62	1.265	0.937	0.781	0.515	92	0.426	0.098	.....	.....
63	1.232	0.904	0.748	0.482	93	0.395	0.067	.....	.....
64	1.200	0.872	0.716	0.450	94	0.362	0.034	.....	.....
65	1.169	0.841	0.685	0.419	95	0.328	.....	.....	.....
66	1.138	0.810	0.654	0.388	96	0.291	.....	.....	.....
67	1.108	0.780	0.624	0.358	97	0.250	.....	.....	.....
68	1.078	0.750	0.594	0.328	98	0.203	.....	.....	.....
69	1.048	0.720	0.564	0.298	99	0.142	.....	.....	.....

Alarm Indicates When Chart on Meter Gives Out

BY JOHN E. MCCARTHY
Load Dispatcher Westchester Lighting Company, New Rochelle, N. Y.

TO NOTIFY the attendant when a new chart is needed on any type of curve-drawing instrument using a linear chart the device illustrated herewith has proved satisfactory. The alarm consists of a bell wired in parallel with as many meters as desired.

The curve-drawing element of a meter is shown in A, where 1 is the arm for keeping the chart in place, 2 the metal fingers for keeping the paper smooth on the metal surface, 3 and 4 the slot to which is attached the alarm device. The actual device consists of a small brass finger, shown in B, having a binding post, 5, soldered to it. The contact point is shown by 6. The assembly of this finger to the slot, 4, is shown in C. A small piece of mica, 7, is placed above and below the contrivance and is inserted and held tight in slot 4. The contact point is then bent down to maintain a pressure on 3. The surface under the contact should be cleaned to remove any lacquer which may be present.



BELL CIRCUIT CLOSED WHEN METER CHART RUNS OUT

In operation the chart is inserted in the instrument between the contacts 6 and 3. As soon as the paper runs out and passes from under the contact the bell circuit is closed. The device as shown is especially devised for type C General Electric Company curve-drawing meters, but can be changed so as to fit any other type.

COAL SCRAPER OPERATED BY TRACTOR USED BY UTICA COMPANY

Tractor Handles Coal at a Cost of $0.026 per Ton

BY W. T. CONLON
Utica Gas & Electric Company, Utica, N. Y.

THE adaptation of a caterpillar tractor to coal handling and storage at the Washington Street steam station of the Utica Gas & Electric Company has proved most satisfactory in the short time that it has been in use. This tractor, shown herewith, is a "Cletrac Model W," with Gustav Schaeffer Wagon Company automatic loading and dumping scrapers. One 5-ft. scraper, which handles approximately ½ ton, and one 7-ft. scraper, which handles ¾ ton of coal for each trip, are used.

Coal is taken from the cars by either the locomotive crane or telpher transporter and placed in low piles, from which it is scraped into place by the tractor and scraper. After this process a "drag" 5 ft. wide, made of 60-lb. standard railroad rails, is used behind the tractor to drag the coal and pack it. This minimizes the air spaces between the particles and lumps of coal and makes an even distribution of "fines" and "lumps" in the storage of the average "run-of-mine" coal, thus eliminating air pockets and reducing possibilities of fire. A repetition of this operation stores the coal in layers, an additional prevention against fire, and also makes the same ground area capable of holding 30 per cent more coal.

On reclamation, the coal is scraped into a position where it can be handled to cars by the locomotive crane or by the telpher transporter directly to the crusher house.

The cost of operation of one machine and scrapers is given in the accompanying table.

The figures given are based on only twenty days' operation, and some differences may be encountered over a longer period of time.

In addition to the work in coal handling, the tractor has been used in handling heavy equipment through deep snow where trucks failed because of poor traction, also in handling snow with scraper to clear street.

COST OF OPERATING ONE MACHINE WITH SCRAPERS

Fixed charges per day, 13 per cent on $1,400 invested	$0.60
Gasoline and oil, 15 gal. gasoline, 1 qt. oil	3.30
Labor, one man	5.00
Maintenance (estimated)	0.35
Cost to operate and maintain, one day	$9.25
Tractor in operation, twenty days	$185.00
	Tons
Coal into storage	5,000
Coal from storage	2,000
Total coal handled	7,000
Cost per ton for handling, $185 ÷ 7,000	$0.026
Estimated capacity in handling of coal in conjunction with crane or transporter, tons per hour	30

Overhead Distribution Construction

Standardized Practice as Developed and Used by the
WEST PENN POWER COMPANY, PITTSBURGH

Minimum Clearances for Distribution Lines

Clearances.—Clearances not less than those shown in Table VIII shall be maintained at all supports. Clearances between wires not less than those shown in Table IX shall be maintained at wire crossings (see Fig. 34). Clearances to ground not less than those shown in Table X shall be maintained at road crossings, etc. (see Fig. 35).

Line conductors of voltages between 300 and 5,000 shall be so arranged that they do not come nearer than 3 ft., measured horizontally, from any point on the surface of a building or its attachments, or nearer than 8 ft. above the top of any building or above any balcony or other platform crossed over. Conductors of voltages above 5,000 shall be as high as the cornice of any building which is near the line. If the conductors are of voltages above 5,000 and are within 10 ft. of a building they shall be at least 8 ft. above the cornice.

TABLE VIII—CLEARANCES OF WIRES AT SUPPORTS

Nature of Clearance	Conductors: Less than 7,500 Volts (In.)	Conductors: 7,500 to 15,000 Volts (In.)
Horizontal separation between line conductors not of the same phase or polarity	*12	15
Clearance from span and guy wires attached to the same pole or from vertical or lateral conductors of other circuits	6	9
Clearance from surfaces of poles or cross-arms or from vertical or lateral conductors of same circuit	3	5

* Where conductors of less than 750 volts, all of one material, are supported on vertical racks in spans averaging not to exceed 150 ft., this value may be reduced to 4 in. and applied for vertical clearance.

TABLE IX—CLEARANCES BETWEEN WIRES AT CROSSINGS

Wires Crossed Over	Wire Crossing Over: Guys, Messengers, Span Wires, Etc. (Ft.)	Wire Crossing Over: Supply Conductors (Ft.) 0-750 Volts	Wire Crossing Over: Supply Conductors (Ft.) 750-7,500 Volts
Guys, messengers, etc.	2	2	4
Signal, telephone, etc	2	4	4
Services (less than 750 volts)	2	2	4
Trolley-contact conductors	4	4	6
Supply, 0-750 volts	2	2	2
Supply, 750-7,500 volts	4	2	2

TABLE X—CLEARANCES OF WIRES TO GROUND

Nature of Crossing	Signal, Guy, Span and Lightning Protection Wires, Supply Lines or Services Less than 300 Volts to Ground (Ft.)	Supply Lines, 300 Volts to Ground up to 15,000 Volts (Ft.)
Crossings over track rails of railroads handling freight cars where brakemen are permitted on top	27	28
Crossings over or along streets or alleys in urban districts or over track rails not included in the above	18	20
Along roads in rural districts	15	18
Crossings over spaces or ways accessible to pedestrians only	12	15

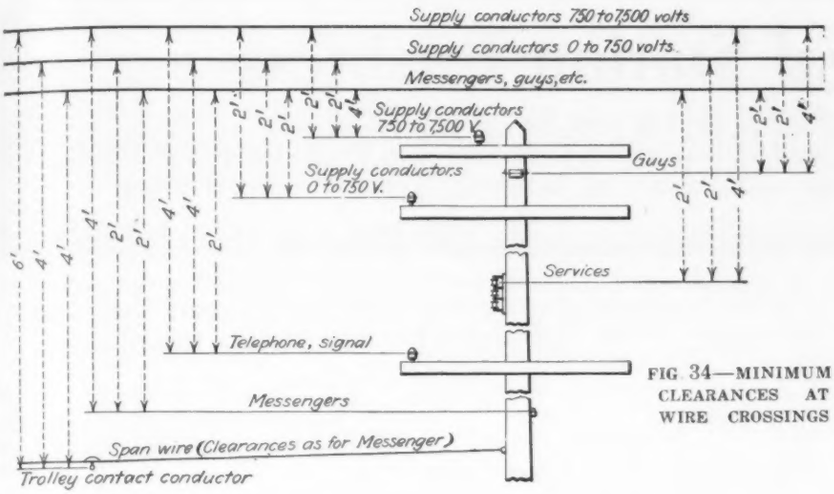


FIG 34—MINIMUM CLEARANCES AT WIRE CROSSINGS

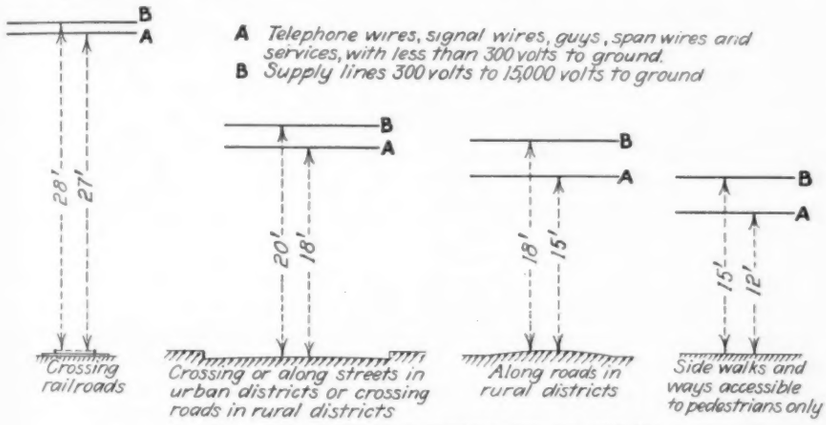

A Telephone wires, signal wires, guys, span wires and services, with less than 300 volts to ground.
B Supply lines 300 volts to 15,000 volts to ground
Crossing railroads
Crossing or along streets in urban districts or crossing roads in rural districts
Along roads in rural districts
Side walks and ways accessible to pedestrians only

FIG. 35—MINIMUM WIRE CLEARANCES TO GROUND

In general, conductors shall be so arranged as to hamper and endanger firemen as little as possible in the performance of their duties.

Electric Truck Winch with 10,000-Lb. Pull

BY J. R. COXE
Superintendent of Transportation New York & Queens Electric Light & Power Company

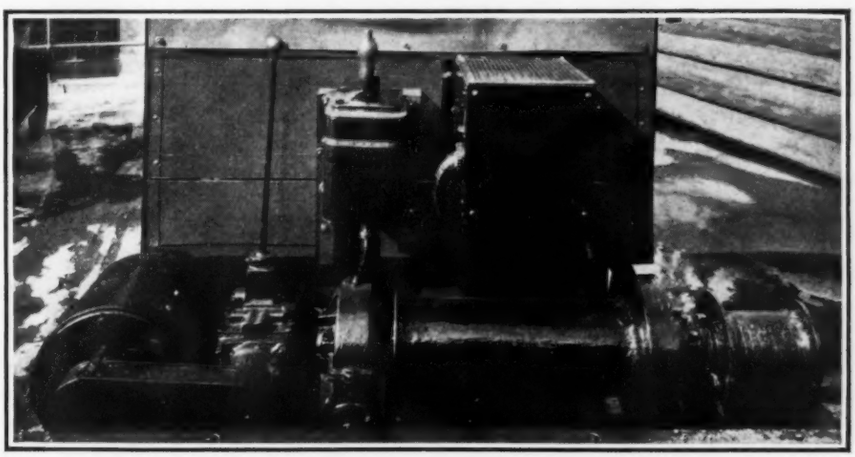
A WINCH for pulling underground cables should, to be suitable for the average conditions encountered by power companies, have a pulling capacity of not less than 10,000 lb. Such a winch for use on an electric truck has been satisfactorily developed by the author in co-operation with the Silent Hoist Company of Brooklyn, N. Y. As a series motor is used to drive this winch the very desirable speed-torque characteristics of this type of motor are utilized to advantage.

This electric truck winch consists of four distinct units—the winch proper, auxiliary transmission, motor and controller. The capacity of the machine is considerably in excess of 10,000 lb. draw-bar pull on a single line at line speeds of 35 ft. to 175 ft. per minute with two intermediate speeds, at the normal speed of motor. The controller is of the reversing drum type, with four points forward and four points reverse. The motor is of the series automotive type, 40 amp. to 60 amp. at 80 volts to 85 volts, and the battery is of the "Exide Ironclad" type.

The winch unit has also been developed especially for cable-pulling purposes and for mounting on electric vehicles. To obtain the maximum strength and rigidity with the minimum of weight, the winch is made entirely of steel. Electric steel castings and steel forgings are used where cast iron has been customary on ordinary hoisting machinery.

The winch occupies a space 18 in. in depth in back of the driver's cab. The drum has a capacity for storing 1,100 ft. of ½-in. steel cable. The worm-gear drive is compact for the large gear reduction obtained and consists of a phosphor-bronze worm wheel and nickel-steel worm hardened and ground, running in a bath of oil. No clutches or brakes are necessary, the entire operation of the machine being handled with an electric controller. Interposed between the motor and the worm-gear drive of the winch is the four-speed transmission, the drives being by silent chain. Of course, the principal function of the auxiliary transmission is to allow a larger range of working speeds within the normal speed range of the motor.

Dynamometer tests in pulling 400-ft. sections of 500,000-circ.mil three-conductor cable indicated a pull of 12,000 lb. On maximum pulls that will average 10,000 lb. the electric winch draws 100 amp., pulling at a line speed of 50 ft. per minute. The current used may seem to be at a rate so rapid that it will quickly exhaust the battery. However, let us consider this pull as necessary for the entire section. At the line speed noted it will take eight minutes to pull in 400 ft. of cable. The average 5-ton vehicle will draw 50 amp. to operate at a speed of 10 miles per hour. The energy consumption of the winch, therefore, in pulling in a 400-ft. section of three-conductor cable weighing 16 lb. per foot has not exceeded the energy required to run the truck 2⅔ miles.



HEAVY-DUTY WINCH DEVELOPED FOR PULLING SUBWAY CABLES

Central Station Business

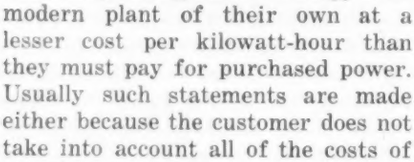
Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Costs of Purchased Power and Private Operation

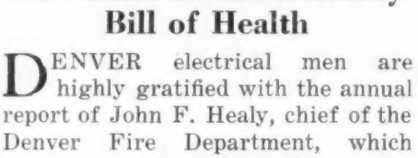
POWER users frequently confront the central-station company with the assertion that, in their particular case, they can generate energy in a modern plant of their own at a lesser cost per kilowatt-hour than they must pay for purchased power. Usually such statements are made either because the customer does not take into account all of the costs of private generation or else because he is trying to drive a sharp bargain with the power company in hope of obtaining a more advantageous rate. Generally it is only in most unusual or peculiarly favorable conditions that the isolated plant is really more economical.

To meet such arguments the Duquesne Light Company, which supplies many large power customers in and about Pittsburgh, has prepared curves showing the comparative fixed charges and total costs for purchased power and steam-turbine operation to provide 1,500 kw. capacity.

The accompanying charts show the comparisons worked out under the company's wholesale light and power rate at load factors from 10 to 40 per cent. It will be noted that there is a marked economy in favor of purchased power.



COMPARATIVE COSTS OF PURCHASED POWER AND STEAM-TURBINE OPERATION—1,500 KW. CAPACITY



COMPARISON OF FIXED CHARGES FOR PURCHASED POWER AND STEAM-TURBINE OPERATION—1,500 KW. CAPACITY

Fire Chief Gives Electricity Bill of Health

DENVER electrical men are highly gratified with the annual report of John F. Healy, chief of the Denver Fire Department, which does not make any reference to actual or alleged electrical causes of fires in that city during 1923. Another interesting feature of the report is the fact that the number of fires and the amount of damage done was less in 1923 than in 1922. Estimated total damage for 1923 was $536,787, while the figure of the previous year was $615,955.

It will be remembered that Chief Healy is an ardent advocate of the proper use of electrical equipment and that several stories have been given national prominence in which he said that electricity could be charged as a cause of fires only when due to carelessness or ignorance on the part of some one.

Four Ways of Bettering Public Relations

"ARE we all cognizant of the benefits of good public relations?" was asked recently by F. R. Coates, president of the Toledo (Ohio) Edison Company, before a gathering of central-station executives. The first person to be "sold" on their value is the chief executive, he declared. Four methods were suggested—(1) to acquaint himself first-hand with the service which the company is rendering; (2) to get personally acquainted with the employees; (3) to develop intimate contact with the public, and (4) to know the press.

No member of a utility company should lean backward in carrying out regulations, he declared. The cashier's department, claim department or executive can win an argument but lose a customer by doing so. Sitting behind a desk can never bring hearty co-operation. Getting acquainted with the work of individual employees is an executive's obligation, Mr. Coates asserted. A little praise and sympathy occasionally are very beneficial; these will make the employees work for the company instead of against it. Selling securities to the employee is also helpful, as are company conferences on utility problems to avoid dissemination of the wrong information.

"Above all things, adhere to a square deal," Mr. Coates urged. "Have a kind word for all, exercise patience, avoid red tape, keep the executives' doors open to the public, make no promises that cannot be fulfilled and be careful in telephone conversations.

"The more that constructive utilities' representatives are engaged in civic activities, the bigger the company will stand in public opinion. More hostility is due to misinformation and poor service than anything else. If the individual companies do not copy the organization of the National Public Relations Section in their local activities, the effort to secure

better public relations goes for naught. Public speeches on utilities, lectures before schools, clubs, etc., women's public relations committees, sale of company stock to customers and the like are all beneficial. If the minds of the younger generation are properly trained, the utilities will not have to contend with the problem which they are now facing."

Short-Cutting Customers' Accounting

"Bookkeeping Without Books" as First Developed at Baltimore—Outstanding Feature of Two Systems—Objections and Advantages

BY P. H. MYERS
Assistant Director Bureau of Commercial Economics, Inc., Chicago

TO USE the chronological ledger record or not to use it for customers' accounts is a question still before many public utilities. Shall the company continue to maintain a running record of meter readings, consumption and billing for each customer on some one of the many forms of ledger sheet, or shall it abandon this more conservative plan for the short cut in customers' accounting now well known by the name "bookkeeping without books"?

What this clever phrase indicates, of course, is the abandonment of that time-honored fundamental of double-entry bookkeeping, the ledger. The new system is built on the exception principle. Its ledger is kept for delinquent customers only; those who pay on time constitute a cash business which needs no ledger record. This method, like all systems of customers' accounting in public utilities, has certain fundamentals. Meters to register consumption are installed in customers' premises. These meters are read periodically and the readings entered on a meter-reading record. This record shows the customer's name and address, data regarding the meter itself (location, number, date set, etc.) and the actual meter readings for one or more years. It is the basis for billing and bookkeeping. Sometimes the consumption and amount of the bill are calculated and entered on the meter-reading record as an aid to the billers.

FEATURES OF SHORT-CUT SYSTEMS

There are two well-recognized ways of keeping a delinquents' ledger, and they are the distinguishing features of the systems known as the "Baltimore system" and the "register sheet system." The Baltimore system makes use of a stub (Fig. 1A) called the ledger record, in addition to the cashier's stub, which stub is detached and filed and becomes the basis for the ledger record. The bills are registered in the same or in a separate operation, depending on whether they are prepared by machine or not. The register sheet system derives its name from the fact that the register, which is prepared by machine by carbon process in the same operation as the bill, becomes the basis for the customers' record.

Under the Baltimore system cashiers' stubs, representing cash payments, are filed by districts or discount dates until after the discount period, when they are sorted into meter-book order and forwarded to the bookkeepers. The bookkeeper then "posts his cash" by matching the cashier's stubs with his ledger record stubs and withdrawing from the file all those thus matched. Because this posting is done only at the end of the discount period, when the majority of accounts are paid, it becomes a very fast operation. The remainder of the stubs, those not matched, represent the delinquent customers and form the ledger for the month. They are stitched together to form a little book, and actual cash postings are made to this ledger as payments are subsequently received. When the next month's bills are prepared the amounts still remaining unpaid are entered on the new bills as arrears.

Under the register sheet system (Fig. 2A) the register sheet is first run through the addressograph machine, which imprints the name, address, and so on, on every line at the right in meter-book order. Bills are then written on a machine, the billing data being recorded opposite the respective names on the register sheet by means of carbon. Under this system the bill (Fig. 2B) has no extra stub; the register sheets for a route of bills are inserted in a binder to form the customers' record. Cashier's stubs, representing cash payments, are held until the end of the discount period, as in the other system. They are then forwarded to the bookkeeper, who posts these payments opposite the appropriate names on the register sheet by means of a rubber "paid" stamp. Payments subsequently received are posted by means of a date stamp, to make them distinctive. When the new bills are prepared at the beginning of the next period, unpaid amounts, shown by open spaces in the paid column, are entered on the new bills as arrears.

PRACTICAL ONLY WHEN DELINQUENTS ARE FEW

It is obvious, of course, that bookkeeping without books, based as it is upon the exception principle, is practicable only as the number of delinquent accounts to be carried forward as arrears bears a small ratio to the total. A desirable figure is approximately 20 per cent. The question of when a bill becomes delinquent is important. For companies having a discount period this

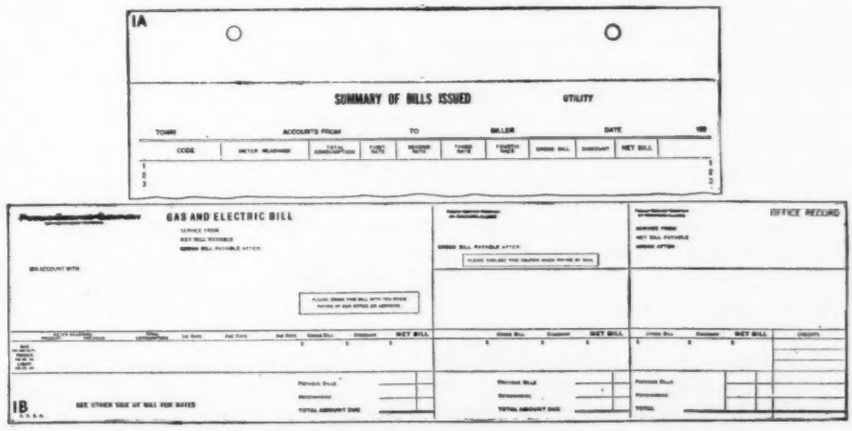


FIG. 1—BALTIMORE SYSTEM
This system uses a stub (A) as a ledger record in addition to the cashier's stub, which is filed, serving as a basis for the ledger

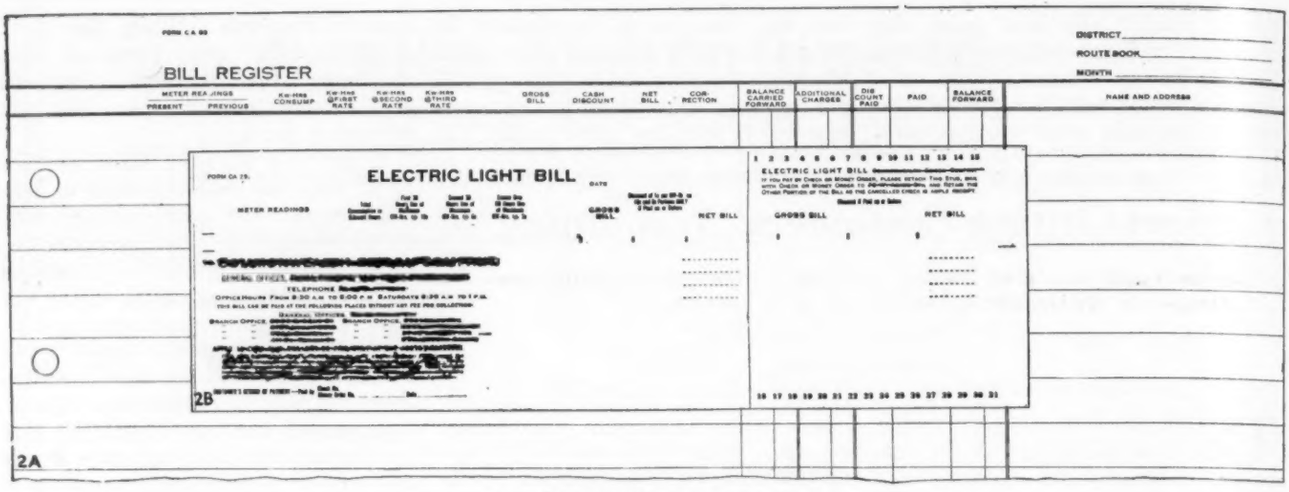


FIG. 2—REGISTER SHEET SYSTEM
The register (A) is recorded at the same time the bill (B) is made out through the use of a carbon sheet

question is answered automatically; for other companies it must be determined arbitrarily. Under these conditions either of the developments of the idea of bookkeeping without books should be practicable for adoption by any company.

An important consideration is the care of the meter-reading record, for it constitutes the only chronological record in one place of the meter readings (in some cases of consumption and billing also) of the customer. The meter book should be kept intact, and more than ordinary care should be exercised to prevent its loss. It thus assumes an importance not before recognized.

Other criticisms charge, first, that in general it is more difficult to obtain information as to the status of a customer's account under the new plan than under the old; second, that it is next to impossible to prepare a transcript of a customer's account over a long period, and, third, that on the day the meter book is on the street in the hands of the meter reader reference is absolutely impossible. Those who have used the systems, however, give assurance that these difficulties either do not exist or are greatly exaggerated.

One who has been in charge of this work in his company for several years says: "It would be altogether feasible to build up a meter book if one were to be lost. In our experience we have never lost or even mislaid a meter book, but just to satisfy ourselves we removed a meter book from its file at night and then announced its loss and gave instructions to build it up. It was reconstructed in twenty-four hours."

A company making a test of the register sheet system on 20,000 accounts for several months past has found it to be altogether satisfactory. The official having the test in charge said: "We have found none of the anticipated difficulties in our use of an addressographed bill register with our modified Baltimore bookkeeping system. This system, with its meter balance and credit card, should be safer than our present system."

An official in another company who had been in charge of an installation in two districts reported at the end of a year's trial that the system had proved successful and that he had no hesitancy in recommending it for installation in the other districts of the company. Economy, of course, is the motive for adopting any short cuts in bookkeeping. Here are some of the reasons for adopting such a system. The time required to make debit postings for gas or electricity to the ledger is saved. A considerable part of the time of making credit postings to the ledger is saved. The cost of labor and supplies in the biennial or quadrennial rewriting of ledgers is saved. There are no heavy ledgers to handle.

Increased speed in billing is secured in cases where the bill is prepared and the ledger sheet posted in one operation. The time required to get out bills after meter reading is reduced, with consequent interest savings. The efficiency of bookkeepers is increased by the simplified system, and they can handle more accounts. The system is in high favor with bookkeepers.

Combined experience seems to indicate that a saving of at least 10 per cent may be expected through the adoption of this system. In addition, efficiency and safety are increased. That the alleged weaknesses are fallacious and that the savings and efficiencies are real are indicated by the steadily growing number of companies adopting the stub plan or the register sheet development of this system.

"Say It with a Smile" Over the Telephone

ON THE theory that a customer's ill will may easily be incurred by thoughtless or abrupt conversation over the telephone the California Oregon Power Company has at Medford, Ore., attached the plaque shown in the accompanying illustration to the mouthpiece of every telephone on the system. To quote from the company's statement: "We have realized that public relations is an all-important subject and have adopted the use of this plaque for the purpose of continually reminding us that a telephone conversation furnishes a means of contact with the public which may be either used to improve public relations or to injure them."

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Photostat copies or English translations of complete articles will be furnished at cost upon request

Hydro-Electric Development and Steam Equipment

Surface Yield from a Hydrographical Basin.—The yield from a hydrographical basin is measured either as a percentage of the rain falling on the basin or else the losses for any period, usually a year, are estimated, or are ascertained by observation of the stream flow of the basin and the difference between the rainfall and the losses in the yield from the basin calculated. The conditions which influence the yield are the amount and intensity of the rain falling on the basin, the slope of the ground surface, the amount and nature of the vegetation, the climatic conditions obtaining at the locality and the geological formation. All of these factors are treated at length. Actual figures on various basins are given for the various portions of the water-year, which consist of the replenishing, storage and growing periods.—*Engineering (England)*, Feb. 15, 1924.

Pulverized Coal—Its Preparation and Utilization.—R. JACKSON.—The author reviews the progress made with pulverized fuel, especially in France, where low volatile and waste fuels are used, and in the United States, where the annual consumption of pulverized coal exceeds 30,000,000 tons, of which some 2,500,000 tons are used for steam raising. He then goes on to discuss pulverizers, pendulum mills, storage bins, feeders and burners.—*Engineer (England)*, Feb. 15, 1924.

Generation, Control, Switching and Protection

Condenser Performance. — JOHN BRUCE.—Economical operation of power stations can be influenced to a very great extent by condensing-plant performance. This article contains a brief description of a simple and easy applicable method for checking the condenser performance of a generating unit and further describes a system whereby a continuous tabulated and graphical record of such performance can be recorded from day to day and so show the performance of the plant at a glance. Methods described are those that are used at the Dalmarnock generating station of the Glasgow Corporation Electricity Department of Scotland.—*Electrical Review (England)*, Feb. 1, 1924.

Reliable Switch Gear.—W. HÖPP.—Authoritative commissions have established rulings pertaining to the insulation, heating, voltage limits, rupturing capacity, mechanical rigidity, etc., for electric switch gear, and these have resulted in a marked improvement and some standardization of the apparatus concerned. Very little has been done, however, to provide calculating and testing methods to determine the inherent mechanical safety of all kinds of switches, although it is known that just in this respect great variance and uncertainty may be found in almost all existing designs. The purpose of this paper is not only to point out these deficiencies, but also to show the great value of a mathematical analysis in the correct design of different types of switches. For every switch mechanism a simple and transparent mathematical formula may be established which will give the most efficient and dependable solution for the particular device under consideration. A special chapter is devoted to the very important catch mechanism, toggle joints and other mechanical releases found on all automatic breakers, showing best solutions for every case. Right and wrong methods and practical examples aid to illustrate the author's points. — *Elektrotechnische Zeitschrift*, Jan. 31, 1924.

Checking the Operation of Hydro-Electric Units.—RALPH BROWN.—Detecting lost motion in operating-cylinder mechanism, checking output of unit, causes of reduced capacity and scheduling the work when a unit is taken out of service for repairs are among the subjects covered.—*Power*, March 4, 1924.

Transmission, Substations and Distribution

Calculation of Three-Phase Transmission Lines.—O. BURGER.—This paper contains a useful compilation of simple mathematical formulas for a first approximation of the main data for a power transmission line on a 50-cycle system. The question of economy has not been considered, as its introduction would make the formulas both complex and not fully reliable on account of widely varying costs of basic materials such as steel, copper, aluminum, oil, etc. From a total of twenty-nine formulas of utmost mathematical simplicity, a few curves and tabulations complete data for any kind of transmission line may be obtained with an accuracy in many cases sufficient for practical use. Overhead lines as well as underground cables are considered. Ohmic resistance, inductance, capacity, choice of voltage, use of reactors, heating, power factor and corona losses are formulated in such a way as to permit their computation with the slide rule. A practical example is introduced (to transmit 40,000 kw. at 100 kv. over a distance of 60 miles) to illustrate the use of the formulas. — *Siemens Zeitschrift*, January, 1924.

Substations of 100 Kv. in Saxony.—A. RACHEL. — An extended 100-kv., three-phase transmission system over 200 miles in extent, tying together a number of power plants, serves the general electrification of the German province of Saxony. The author explains the layout of some of the outstanding transforming stations with complete plan drawings. All stations are completely housed in for both the high-voltage and the low-voltage side. Fireproof design, a maximum of daylight illumination and safety of operation have been the most important underlying principles in the layout of these stations. It is of interest how the total cost of a 30,000-kva. substation is segregated:

	Per Cent
Switchgear	44.6
Transformers (two three-phase, 15,000 kva. units)	20.1
Auxiliaries (transportation and lifting facilities, cooling water, repair shop)	3.6
Building	24.7
Excavations	7.0

Some examples of very long spans with the 100-kv. lines over rivers and valleys are shown on scale drawings. The average cost of the 100,000-volt double-circuit, three-phase line was $33,000 for aluminum and $40,000 for copper conductors per mile. The paper contains a great many details of line construction with valuable operating experiences. — *Elektrotechnische Zeitschrift* Jan. 10 and 24, 1924.

Units, Measurements and Instruments

Directions for the Study of Varnished Cotton Cloth.—The British Electrical and Allied Industries Research Association has drafted specifications in which directions are given for a comprehensive study of the electrical and mechanical properties of varnished cloth with a view to the adoption by makers and users of uniform methods of test and insuring that the important properties of the material with respect to service conditions shall be thoroughly investigated.—*Journal of the Institution of Electrical Engineers (England)*, February, 1924.

Equipment of Electrochemical Laboratory.—H. PAWECK.—As an addition to the technical university of Vienna an old governmental building has been changed over into an up-to-date electrochemical laboratory. Transformers totaling 200 kva. are installed in the basement, receiving three-phase current from the city power station and feeding a 150-hp. motor-generator so equipped as to deliver a number of different voltages and currents. In addition, two large storage batteries are installed, with a selector board for series-parallel or group connections. A wiring diagram of the installation is shown. A lecture room for 110 students and several large chemical research laboratories are provided, with a total of fifty individual laboratory desks, each equipped with water, air, gas and electric connections. In a special electric furnace room the manufacture of aluminum, calcium carbide, steel alloys and other electrometallurgical products may be demonstrated on a sizable scale. — *Elektrotechnik und Maschinenbau*, Jan. 20, 1924.

Automatic Transmission of Power Readings.—B. H. SMITH and R. T. PIERCE.—The need of centering information at one point as to power conditions in large systems for load dis-

patching, billing or other purposes has led to the development of various means of transmitting power readings over long distances. The author discusses the following methods which may be employed for remote metering: frequency, inverse current, potentiometer, voltage, current and impulse.—*Journal of A. I. E. E.*, February, 1924.

Illumination

Modern Methods of Microscope Illumination.—CONRAD BECK.—In this short article is presented a method of high-power dark-ground illumination particularly adapted to microscopes. The focusing type of illuminator described will focus through any slip from ½ mm. to 1½ mm.—*Journal of Scientific Instruments (England)*, February, 1924.

Lighting System of the Leviathan.—W. N. ZIPPLER.—A description is presented of the lighting system which has been installed on the *Leviathan.* A full account is given of the wiring system and difficulties encountered in reconditioning the vessel due to faults in the original installation.—*Transactions of the I. E. S.*, January, 1924.

Motors and Control

Speed Regulation of Direct-Current Motors with Electron Tubes.—W. TAEGER.—To maintain constant speed of a direct-current motor, or to secure a constant potential on generators, the author describes the successful use of electron tubes. The machine to be regulated carries an auxiliary field winding, which acts in opposition to the main field. Through this auxiliary winding the current from a small tachometer dynamo, connected rigidly to the main machine, is passed over two or more electron tubes in parallel. Grid, anode and filament heating batteries are placed in the tube circuit. Not every kind of tube is suitable for this purpose. The characteristic of the tube ("steepness") has to stay within certain limits, as otherwise the range of regulation would be too small or the required number of tubes too large. Mathematical means of determining the resistance of the auxiliary winding and the number of tubes required are given in general terms, with a practical example.—*Elektrotechnische Zeitschrift*, Feb. 7, 1924.

Reconnecting Direct-Current Windings.—A. C. ROE.—Two-layer wave windings as used on drum-type armatures are considered. Comparisons are made between the lap and wave windings and the effects on speed and voltage when windings are reconnected.—*Power*, Feb. 26, 1924.

Heat Applications and Material Handling

Chemical Aspects of Welding.—J. R. BOOER.—Although the chemical aspects of welding have been discussed in varying detail in most manuals on welding, there has, according to the author, been a lack of co-ordination of what has been done, and it is with this purpose in mind that he presents these data emphasizing the importance of what might be called the chemical side of welding. He considers the general physical phenomena, oxidation and reduction, metallic oxides, electric arc-flame combustion, reducing agents, slags, fluxes and chemical control.—*Engineering (England)*, Feb. 15, 1924.

Time-Velocity Characteristics of the High-Speed Passenger Elevator.—BASSETT JONES.—The author discusses the psychology of the elevator passenger, the physiological effect on him of acceleration and retardation, the possible improvements in service through increased car velocity, quicker gate and door operation, better signal systems and the use of automatic stops. He then treats of the matter of velocity and advances a method of analyzing time-velocity relations which should be of great assistance to designing high-grade, high-speed elevator installations.—*General Electric Review*, February, 1924.

Electrophysics, Electrochemistry and Batteries

Electric Gas Filters.—C. HAHN.—Practical use of dust precipitation by high-voltage current has been made since 1906, since which time considerable advance has been made in the art, and many installations in various industries are using the method. The system seems to adapt itself to any kind of dust, regardless of its chemical nature. Carbon, cement, blast-furnace gas, dust from tumbling barrels, all are precipitated by static action of direct current. For example, actual measurements on a coke-dust filter showed that the air before entering the precipitator was laden with 50 grams of carbon dust per cubic meter, while it contained only 0.02 gram after passing the filter. Originally barbed wires were used as electrodes, but later smooth rods or plates were substituted with the same result. To hasten the release of the retained dust a mechanical shaking device keeps the grounded electrodes in constant vibration. If dry gases are to be filtered, ordinary iron electrodes are sufficient. The electrodes may be made of iron for dry gas, are galvanized for wet gases and lead-coated for acid fumes. Synchronous motor-driven mechanical rectifiers are recommended to change the 50,000-volt to 100,000-volt alternating current into direct current. On an average 1½ kw. cleans 1 cu.in. of gases per second.—*Siemens Zeitschrift*, January, 1924.

Traction

Locomotives for Riksgräns Railway (Sweden).—F. KUNTZE.—For the 300-mile single-phase railway system between Narvik, Norway, over Riksgransen to Lulea, Sweden, the Siemens works furnished in 1914 eleven double locomotives and in 1922 eleven more, all of the 1C + C1 type. The present paper gives a comparative description of the two groups of engines. The older design had one large motor, driving with an inclined rod a jack shaft, to which three running axles were connected over a horizontal rod. The modern type uses a set of twin motors, operating the jack shaft with two pinions upon one gear wheel, from which the three axles are driven by horizontal rods. The two motors have a one-hour output of 2,900 hp. The new engines cover 5,400 miles every month, pulling ore trains of thirty cars of 35 tons each over grades up to 10 per cent. By changing only the gear ratio the same locomotive may be used for passenger service.—*Zeitschrift des Vereines Deutscher Ingenieure*, Jan. 26, 1924.

Telegraphy, Telephony, Radio and Signals

Characteristics of Telephone Cables.—K. DOHMEN.—At the time the 360 miles of subterranean telephone cable between Berlin and Cologne was installed only the Pupin coil was known as means to make telephonic transmission through such a long cable possible. Consequently copper wires of rather large diameter had to be used. The sizes decided upon were 2 mm. and 3 mm. in diameter. The economic upheavals caused by the war delayed the finishing of this installation to a time when the electron-tube repeaters were well established. The remainder of the cable was therefore redesigned with much smaller wires to operate with tube repeaters. Wire sizes of 0.9 mm. and 1.4 mm. diameter were selected for the modern part of the cable and all the new branch lines. Two types of cable have been standardized for the new inter-German telephone network, namely, 98-pair and 166-pair cables. The innermost two pairs of wires are inclosed in an individual lead sheath and represent the emergency conductors in case of a damage to the cable. The main data of the two cables are given in the accompanying table.—*Elektrotechnische Zeitschrift*, Feb. 7, 1924.

DATA ON CABLE USED IN BERLIN-COLOGNE TELEPHONE NETWORK

	Thickness of Lead, Mm.		Over-All Diameter,	Weight,
Pairs	Inner	Outer	Mm.	Kg./Km.
98	1	3	64	12,000
166	1	3.2	75	14,800

Miscellaneous

Industrial Research, with Special Reference to Electrical Engineering Development.—W. WILSCH.—The author claims that in England very little attention has been paid to new developments. For this reason few inventions have been carried to a conclusion in that country compared with the great amount of original scientific work which has been successfully accomplished. The reasons for this are analyzed and the cause is traced to lack of the co-operation necessitated by modern manufacture. This want is filled by development departments, the various functions of which are dealt with. Their object is to remove all non-standard work and technical troubles from the shops and drawing offices and to provide the original and matured designs of new and improved articles for manufacture. Practical matters, including building and equipment, procedure and development, the recording and filing of results and data and the indexing of literature and information are discussed.—*Journal of the Institution of Electrical Engineers (England)*, January, 1924.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Growth in 1917-1922

United States Central-Station Census Confirms Estimates of Great Electrical Expansion

PRELIMINARY figures of the United States Census of Central Stations for 1922, which were made public yesterday, present a striking story of the growth which took place in the industry during the period from 1917 to 1922. The figures cover both commercial and municipal plants and both those generating energy and those distributing purchased energy. The output of private generating plants operated by mines, factories, hotels and other enterprises not in the nature of public utilities is not included, nor is the output of plants operated by federal government and state institutions.

These census returns relate to the same points as do the data published in the ELECTRICAL WORLD for March 1. They show outstanding advances in the five-year period of 123.0 per cent in wages paid, 103.5 per cent in income, 101.5 per cent in expenses, 77.2 per cent in number of customers served and 59.1 per cent in generating rating. The 1922 income figure of $1,072,120,000 compares with the ELECTRICAL WORLD figure of $1,084,000,000 for the same year. The number of employees is given as 150,762, which agrees very closely with the ELECTRICAL WORLD estimate of 150,000. In number of customers the figure of 12,723,809 is about 3 per cent greater than the ELECTRICAL WORLD estimate of 12,353,570 as of January 1, 1923.

The rating of prime movers used in the industry aggregates 20,296,235 hp., an increase of 56.9 per cent over 1917. Of this increase nearly 6,000,000 hp. is credited to steam engines and turbines and about 1,500,000 hp. to waterwheels and turbines. The rating of internal-combustion engines increased 44 per cent during the five-year period.

UNITED STATES CENSUS OF CENTRAL ELECTRIC STATIONS

	1922	1917	Per Cent. of Increase*
Number of establishments†	6,356	6,542	— 2.8
Commercial	3,775	4,224	—10.6
Municipal	2,581	2,318	11.3
Income‡	$1,072,120,000	$526,894,000	103.5
Electric service	$1,020,439,000	$502,060,000	103.3
All other	$51,681,000	$24,834,000	108.1
Total expenses, including salaries and wages	$859,625,000	$426,568,000	101.5
Number of persons employed	150,762	105,541	42.8
Salaries and wages	$212,433,000	$95,242,000	123.0
Total horsepower of prime movers	20,296,235	12,936,755	56.9
Steam engines and turbines:			
Number	6,525	7,487	—12.8
Horsepower	14,171,222	8,449,076	67.7
Internal-combustion engines:			
Number	3,256	2,934	11.0
Horsepower	302,995	210,406	44.0
Waterwheels and turbines:			
Number	3,481	3,374	3.2
Horsepower	5,822,018	4,277,273	36.1
Kilowatt capacity of dynamos	14,313,000	8,994,000	59.1
Output of stations, kilowatt hours	40,291,536,000	25,438,303,000	58.4
Number of consumers' meters in service	12,569,416	7,102,569	77.0
Number of customers	12,723,809	7,178,703	77.2

* A minus sign (—) denotes decrease.
† The decrease in the number of establishments is due chiefly to consolidations and the extension of transmission systems.
‡ Exclusive of $90,079,953 in 1922 and $59,629,985 in 1917, reported by street and electric railway companies as income from the sale of electrical energy.

Short Circuit Plunges Part of Chicago Into Darkness

Chicago had a lesson on Monday night of this week concerning what electricity means to a modern city. Soon after 10 o'clock a short circuit in one of the main feed wires at the great Calumet generating station put that plant out of service. As a safety measure the company also shut down the Fisk Street and Quarrie Street plants on either side of the Chicago River at Twenty-second Street. That left only the Northwest plant, in Roscoe Street, and a few minor generating stations to carry the load for the entire city.

The greater part of the city was thrown into darkness. South Chicago, Woodlawn, Hyde Park and other southern districts were affected first, but trouble soon spread to the north side. Theater and motion-picture audiences had to find their way to the street through unlighted aisles, and entertainments and dances, as well as private homes, had to resort to gas or still more primitive methods of illumination. The city's pumping plants at Twenty-second Street, Sixty-ninth Street and Chicago Avenue were put out of commission.

The company's direct-current area, including the "Loop," was unaffected at any time. After two hours of work part of the Calumet plant was restored to service and the switches were thrown once more at the Fisk and Quarrie stations.

A. I. E. E. Nominations

Directors Select No Nominee for President, and Members Will Choose Osgood or Skinner

A CLOSE contest for the presidency of the American Institute of Electrical Engineers is indicated by the canvass made, in accordance with the constitution, by the board ofdirectors of the nomination ballots cast for Charles E. Skinner of Pittsburgh and Farley Osgood of Newark, N. J. Meeting in New York on March 14, the board received the report of its tellers, which showed that Mr. Skinner had received 2,448 nomination votes and Mr. Osgood 2,238. The board thereupon decided not to select a "directors' nominee" for the office of president—a unique occurrence in Institute history since the adoption in 1912 of the amendment to the constitution providing for the indication on the ballot of "directors' nominees." In this connection it is interesting to remember that the Institute has nearly fifteen thousand members and that the 4,686 valid nomination ballots cast for president represent therefore only 31 per cent of the names on its roll.

The board selected the following list of "directors' nominees" for the other offices to be filled:

For Vice-presidents—District 1 (Northeastern), Harold B. Smith, Worcester, Mass.; district 3 (New York City), L. F. Morehouse, New York; district 5 (Great Lakes), Edward Bennett, Madison, Wis.; district 7 (Southwest), H. W. Eales, St. Louis; district 9 (Northwest), John Harisberger, Seattle.

For Managers—John B. Whitehead, Baltimore; E. B. Merriam, Schenectady, N. Y.; J. M. Bryant, Austin, Tex.

For Treasurer—George A. Hamilton, Elizabeth, N. J.

The election ballots, including the names of the "directors' nominees" and all other eligible candidates, will be mailed to the membership prior to April 1.

New Superpower Station for New York City

The New York Edison Company is planning the erection of a new steam-electric power station in the Borough of Manhattan. Details are still lacking as to its equipment and ultimate rating. A plot of ground has been purchased at Fourteenth Street and the East River, and on that site it is proposed to have a station in operation in 1926. The load on the system is increasing at such a rate as to make a new station imperative before 1927. It is, of course, to be expected that the power house will embody in its design all the latest and best practices.

Coal-Field Superpower Group Formed

Eleven Companies in Five States Enter Agreement for Interchange of Energy, Thus Linking Generating Equipment Rated at Two Million Horsepower

ELEVEN independent electric light and power companies, serving Ohio, Pennsylvania, Maryland, Virginia and West Virginia, are bringing into being, through the completion of a series of co-operative agreements for the mutual exchange of power, a superpower system which may be described as the coal-field group, covering the area between Cleveland, Erie, the coal fields along the Kentucky-West Virginia state line south of Charleston, W. Va., and a point just outside of Baltimore, and including the entire Pittsburgh district. The participating companies have a combined capitalization of $315,000,000 and a total generating capacity of more than 2,000,000 hp. produced largely by plants in the coal regions.

This group will not only eventually give the important district directly served cheaper power and better service, according to H. Hobart Porter, president of the American Water Works & Electric Company, but represents an important step in the formation of a superpower system covering the eastern part of the United States. In making the announcement Mr. Porter said:

"The importance of linking this group of companies together is based on three things. First, their geographical position; second, the fact that they serve the 'workshop of the world'; third, and most important of all, the means thus provided whereby power generated at the mouths of coal mines can be distributed widely and can be exchanged for power developed by the waters of New England, New York and the Appalachian watershed."

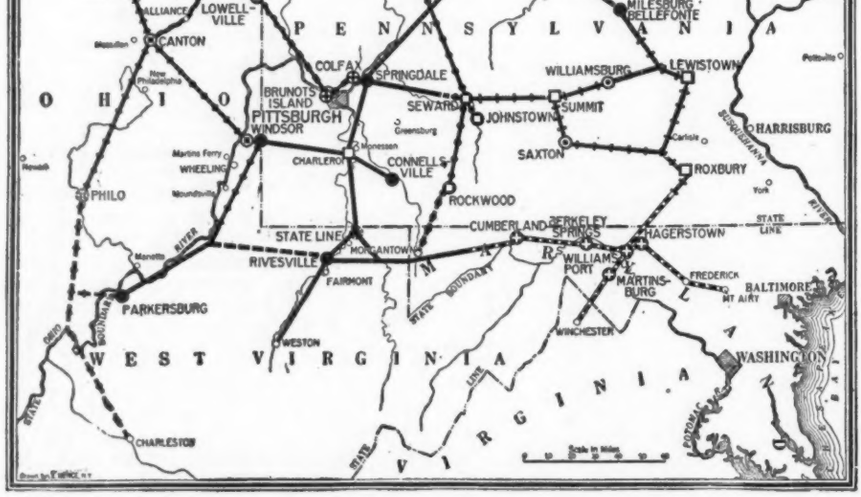
COMPANIES AND PLANTS INVOLVED

The companies entering into this comprehensive agreement for interconnection are the Duquesne Light Company, Penn Public Service Corporation, Potomac Edison Company, American Gas & Electric Company (which controls several operating companies in the region affected), Cleveland Electric Illuminating Company, Ohio Public Service Company, Penn-Ohio Electric Company, Northern Ohio Traction & Light Company, Penn Central Light & Power Company, Keystone Power Corporation, and West Penn Power Company. The population served by these companies is 7,250,000 and the area covered is over 50,000 square miles. Among the cities served are Cleveland, Akron, Canton and Warren, Ohio; Erie, Pittsburgh, Johnstown, Connellsville, Altoona, Butler, Washington, Greensburg, McKeesport and Wilkinsburg, Pa.; Charleston, Wheeling, Fairmont, Clarksburg and Parkersburg, West Va.; Cumberland, Hagerstown and Frederick, Md., and Winchester, Va.

These companies are all financially and corporately independent of each other except that the American Water Works & Electric Company controls the West Penn, Potomac Edison and Keystone Power companies.

Among the large steam plants thus linked together are Springdale, Colfax, Connellsville, Seward, Saxton and Brunots Island in Pennsylvania; Windsor and Rivesville in West Virginia, Williamsport in Maryland and Philo in Ohio.

In addition, there is considerable water power within the territory. A great deal of work has been done on a 40,000 hp. hydro-electric plant on the Cheat River, at the Pennsylvania-West Virginia line, and future developments may cause the production of about 500,000 hp. on this river. There is also potential water power in this area of 130,000 hp. from the Youghiogheny River and 400,000 hp. from the Clarion River, on both of which development work has begun.



COAL-FIELD TERRITORY EMBRACED IN AGREEMENT FOR INTERCONNECTION

St. Lawrence Board Ready

President Appoints Eight of the Nine Members—Hoover Explains Status of Project

DURING the past week President Coolidge appointed eight members of the St. Lawrence Commission of the United States, an additional member to be chosen later from New England. The men appointed are: Herbert Hoover, Secretary of Commerce, chairman; William C. Breed, New York; James E. Davidson, Bay City, Mich.; James P. Goodrich, Winchester, Ind., former Governor of Indiana; James R. Howard, Chicago; James D. Noonan, American Federation of Labor; Stephen B. Davis, Washington, counsel, and Charles P. Craig, Duluth, executive secretary. This commission is "to consider the formulation of such projects as might be submitted for international agreement on construction, finance and administration—all of which, of course, must be of a preliminary nature as a basis for formal negotiations with the Canadian government, and obviously subject to the views of Congress."

In commenting on the appointment of the St. Lawrence commission Mr. Hoover explained that the commission's work will be confined entirely to a study as to the proper time to undertake the development of the stream.

There no longer is question, he said, as to the advisability of developing both the waterway and the power resources of the river, and the only question is whether the work should begin in the near future or be deferred ten or twenty years. He anticipates some continuance of the opposition from New York and Buffalo to the waterway feature, but he declared that any losses these cities might suffer by reason of the waterway would be compensated by the advantages which would come to them by the development of the river's power possibilities.

Mr. Hoover laid emphasis on the fact that there is at this moment a market for the 2,000,000 hp. which can be developed in connection with the project. He pointed out that this fact must be taken into consideration in comparing this project with most large hydro-electric developments where large

blocks of power necessarily must be brought in prior to the development of a market to absorb the energy.

The Canadian government has agreed to the suggestion of the State Department at Washington that two additional members be appointed by each government to the joint engineering board appointed to consider the St. Lawrence project, increasing its total membership to six. This board, of which also Mr. Hoover is the head, is distinct from the respective national commissions of the United States and Canada. Secretary Hughes proposed that the last-named bodies should confer together, but Canada dissented. The joint engineering board, Secretary Hoover made it particularly clear, is to undertake no new engineering investigation of the project. Three exhaustive reports have been made by as capable men as could be found to make a new report. The work of the joint board will be confined entirely to a revision of cost figures to make them accord with present-day prices.

Mr. Hoover also said that his mind was closed on one point, and that was that the St. Lawrence waterways should be developed. It may not come in the present generation, he declared, but it will come in the next. He added that it was inconceivable that the production of power for the use of 50,000,000 people should be abandoned.

New York Legislature Against Lake Michigan Diversion

In accordance with a message from Governor Smith transmitted to the New York State Legislature on March 17 inviting attention to a communication addressed to the Executive by D. B. La Du, State Engineer and Surveyor, the Assembly passed a resolution memorializing the United States Congress to defeat the bills which provide for a diversion of 10,000 cu.ft. per second from Lake Michigan to the Chicago Drainage Canal. The resolution points out that the water thus diverted translated into terms of horsepower represents approximately 500,000 hp. and that its diversion would decrease the total amount of power possible of development in the Niagara and St. Lawrence Rivers by more than 5 per cent. In the Senate a similar resolution is expected to pass.

At Washington, before the House committee on rivers and harbors on Wednesday, Arthur B. White, representing the Hydro-Electric Power Commission of Ontario, opposed the proposed diversion, and the Attorney General of Michigan, who said he spoke also for the States of Indiana, Ohio and Pennsylvania, registered a protest against the bill. The Michigan official insisted that Chicago's use of Lake Michigan water should be limited to 4,167 ft., as stipulated in a permit issued years ago by the Secretary of War. Mr. White denied that power interests on the Dominion side of the international boundary are diverting 45,000 cu.ft. of water from the Niagara River to generate power, instead of 36,000 cu.ft., as stipulated in the treaty between the United States and Canada. Congress is not likely to act on the bill at this session.

Institute Maintains Stand

"A.I.E.E. Standards" Work to Continue with Scope of 1922 Edition as Criterion

REAFFIRMING the McClellan resolution adopted December 14, 1923, the board of directors of the American Institute of Electrical Engineers approved at the meeting held March 14 a report of its sub-committee appointed to "confer with the standards committee for the purpose of determining the methods of procedure that will be acceptable to both the committee and the board of directors."

The formulation and publication of A. I. E. E. standards has constituted one of the most important activities of the Institute during the past twenty-five years. However, since the establishment of the American Engineering Standards Committee—the agency set up by a large number of organizations, including the A. I. E. E., for the coordination of the standardization work of the various member organizations—there has been some question concerning the extent, if any, to which the A. E. S. C. should supersede or modify the work of the A. I. E. E. standards committee. During this time there has been a great deal of discussion in regard to the future activities of the Institute.

Subsequent to the passage of the McClellan resolution, which read: "Resolved, that the board expresses the opinion that the standards committee should take no action that will interfere with the continued construction and publication of 'A. I. E. E. Standards' as its principal function, made from the standpoint wholly of the American professional electrical engineer, and that while doing this it should co-operate to the greatest extent possible with all other bodies interested in standards—this to the end that the integrity of the standards developed by the standards committee within its specific scope and adopted by the Institute shall be maintained," a committee of the board was appointed, consisting of A. G. Pierce (chairman), H. M. Hobart, William McClellan, W. I. Slichter and W. K. Vanderpoel, which conferred with a sub-committee of the standards committee, consisting of F. D. Newbury (chairman), D. C. Jackson, Harold Pender and L. T. Robinson, and the latter committee in turn consulted with various other organizations.

FORMER STAND AFFIRMED

As a result of these meetings and of a very careful study of the whole situation at the present time, the board's committee presented a report last week recommending that the policy outlined in the above resolution of December 14 be reaffirmed and that the work of revision of the present "A. I. E. E. Standards" be actively carried on to completion.

After reviewing the past work of the Institute and its general acceptance as authoritative, the standards having "been found to meet, within their scope, the needs of the industry," the committee points out that the considerable measure of success is in great part due to the fact "that the work has been done from the standpoint of the professional electrical engineer and under the auspices of an impartial professional society of standing." It then proceeds to say:

> With regard to the subject of scope, there can be no hard and fast definition given. We recommend that the standards committee take as a criterion the general character and extent of the 1922 edition of the Institute "Standards" and that special attention be directed to the note entitled "Purpose of the Standards of the A. I. E. E.," on page ii of that publication.*
>
> It is recognized that the scope of the Institute's "Standards" covers only a portion of the required field, but we are satisfied that it is the portion, from the standpoint of the interests of the industry, that can be covered most effectively "from the standpoint of the professional electrical engineer."
>
> The Institute's standards committee should and will continue to maintain those close and hearty relations with other organizations which have proved so effective in the past.
>
> An important agency in promoting the co-ordination of the work of various organizations in the standardizing field is the A. E. S. C., in the establishment of which the A. I. E. E. played the initiating part and in the support of which it continues.
>
> The pending revision of the "A. I. E. E. Standards" is being subdivided into standards relating to component subjects, and it is anticipated that each one of these component standards after its adoption as an A. I. E. E. standard will in due course become an American standard, either by itself or merged with the standards submited by other organizations, by the procedure established by the A. E. S. C. for the purpose.
>
> Your committee, however, cannot too strongly present the importance of first directing the efforts of the standards committee to the completion of its revisions with a view to their early adoption as "A. I. E. E. Standards."

RECOMMENDATIONS OF COMMITTEE

In concluding its report the sub-committee made six recommendations, which are as follows:

1. That this report be adopted with a spirit of action rather than one of sentiment.
2. That it be understood that the policy thus reaffirmed must be substained through the changes of personnel in future boards and committees to permit a constructive forward work of this character necessarily to go on without the interruption caused by uncertainty as to policy.
3. That this settled policy can be sustained only by belief generally in the plan, character, scope, thoroughness and speed with which this work of our Institute is produced.
4. That, to insure the foregoing, earnest attention to it must be given individually by the members of the board both by way of encouragement to the standards committee and by interesting others in Institute circles generally in this work.
5. That it be recognized that the task imposed as to scope, speed of production and co-operation with other associations or groups similarly employed may require greater effort than can be commanded by voluntary contribution, and in view of this that immediate consideration be given to employment of the services of a technical assistant on the staff of the secretary to give active attention under direction of the standards committee to the prosecution of the work.
6. That the standards committee report to the board such changes in Bylaws 11-a and 11-b as will remove any technical delay in consideration of standards as they become ready for release.

The board of directors voted to approve the report referred to above and to adopt all the recommendations referred to therein.

*The statement referred to reads as follows: "In framing these standards the chief purpose has been to define the terms and conditions which characterize the rating and behavior of electrical apparatus, with special reference to the conditions of acceptance tests. It has not been the purpose of the standards to standardize the dimensions or details of construction of any apparatus, lest the progress of design should be hampered."

Ontario Hydro Commission Commended

Gregory Investigating Commission Vindicates Sir Adam Beck, Although It Denounces Some of the Practices That Have Been Followed by the Commission

THE commission which under the guidance of W. D. Gregory has been investigating the Hydro-Electric Power Commission of Ontario for the past two years filed its report on March 13 with the Ontario Legislature. Although made at an expense of more than half a million dollars, the report itself will never become public, having been tabled as soon as presented. It embodied more than a hundred volumes of testimony, in view of which fact the government presented the House with a summary, which was read by Premier Ferguson.

It will be recalled that the investigation was instigated by the Drury (Farmer party) government and that that government was defeated at the general election in Ontario last June. The Conservative party won by a landslide, and Sir Adam Beck was elected to the Legislature from the city of London by a tremendous majority. The investigating committee criticises Sir Adam for arbitrary tendencies while at the same time according him high praise for "his great and notable service to Ontario." Whether or not the change in government had any effect on the final report of the commission, or whether the summary made by the government reflects accurately the findings of the commission, is difficult to ascertain.

General Findings

The report summarizes all the various activities of the commission and contains the following general findings:

"The principle of the public ownership of water powers of the province and their development by the people for the people is, in our opinion, fundamentally sound and should be maintained at all hazards in its full integrity.

"The engineering department of the commission is made up of men of high professional qualifications as engineers, and as such they are serving the commission zealously and efficiently. The various plants of the commission are exceptionally well operated by them.

"The methods of accounting adopted by the commission we believe to be adequate and proper, both in respect to the manner in which the duties are apportioned and as regards the records.

"That the organization administered by the commission is financially sound there is not the slightest doubt. The commission has, to a large degree, a monopoly of something that every one wants. Any organization that has such a monopoly should have no difficulty in paying its way, provided its method of administration is sound. To some of the practices of the commission we take strong exception in our reports, and to these reports we refer.

"The things to which we have taken exception are nearly all matters of administration. But methods of administration can be reformed and wrong methods can be righted.

"We mention a few of the things which, in our opinion, have been wrong:

"(a) There has been too great a tendency on the part of the commission to defer the time for refunding its obligations. There appears to us no reason why the time for contributions to sinking fund to meet the cost of construction should invariably be deferred for five years beyond the time specified in the Power Commission act, whatever the demand for power may be.

"(b) The expressed intention of the commission to extend the time for contributions to the sinking fund in respect of the Queenston-Chippawa undertaking to forty years, with a five-year deferment period, is, we believe, absolutely wrong, and, we are advised, contrary to existing law. We regard contrary to existing law.

"(c) The failure to provide a sinking fund for nearly all of the bonded indebtedness in respect of the Niagara developments, which are operated by the commission as private companies, in the same general manner and to the same extent as is done in respect of cash advances under the Power Commission act, has been, in our opinion, unsound and unjustified.

Estimates Too Low

(d) The principal estimates of cost of developments submitted by the commission to the government have in nearly all cases been far too low. So wide has been the difference between estimates and costs that the fact that the estimates should have been submitted as representing the probable cost of the works seems almost incredible.

"(e) In 1922 the commission took a large portion of its renewal fund, which at that time was in some cases too small, and applied it in payment of outstanding balances due to it by municipalities, and established new renewal rates for the future on a much lower basis. This depletion of the renewal reserves and the reduction in the rate by the commission were, in our opinion, unjustifiable and unsound.

"(f) We fully concur in the opinion expressed by our consulting engineer that the contingency funds of the commission are, as a rule, too low.

"(g) The unauthorized use of $1,100,000 of the funds of the Power Commission for radial railway purposes was wholly unjustifiable, and the amount taken from these funds should be restored without delay."

The investigating commission further finds:

That the Power Commission has frequently exceeded its legal powers and had them extended by the Legislature.

That the government should have fuller information regarding the operations of the Power Commission.

That the Power Commission made a mistake in entering the radial railway field.

That the Central Ontario system should be "unscrambled."

That the powers of the government to guarantee bonds of the Power Commission are too wide.

That there should be regular conferences between the commission and the municipalities.

Cost of Chippawa Development

A study was made by the investigating commission of the estimates submitted by the Power Commission.

The first estimate was dated June 23, 1915, and provided for the development of 100,000 hp. with canal capacity of 6.550 cu.ft. per second at a cost of $10,410,233. This estimate was revised in 1916 and again in January, 1917, when an estimate of $12,490,000 was submitted, which was subsequently discarded. The commission observes that this estimate was not based on sound judgment and was entirely inadequate.

What is known as Estimate No. 2 was submitted on December 26, 1917. It provided for an installation of 300,000 hp. capacity, with a canal capable of carrying 10,000 cu.ft. per second. The amount of the estimate was $24,316,815. This was the last detailed estimate made. Subsequent estimates were based upon the estimate of 1917, with such additions as were decided upon from time to time.

In 1919 a supplementary estimate was made which brought the figure up to about $27,000,000.

The investigating commission reports "that the estimate of $27,000,000 for a 300,000-hp.-capacity canal covered the work as finally constructed, if due allowance be made for quantities not provided for in the estimates and minor changes in design, so that the same plant that the commission stated late in 1919 would cost $27,000,000 actually cost $64,000,000, or, in other words, the actual cost exceeded the estimated cost by $37,000,000."

As to the unjustifiable excess costs, put at $11,800,000, the Gregory commission said: "The rush schedule would never have been necessary had the construction work been under a proper management."

Regarding the relations between the government and the commission, the report states that:

"When the first estimates were submitted and throughout the whole period of the construction, information as to the cost of the work which should have been laid before the government was withheld, and there was a notable lack of frankness on the part of the commission. This led to misunderstandings and mistrust."

The report states that the cost of the full development of 550,000 hp. will be $82,483,914.

Based on the figures of the Hydro-Electric Power Commission, the annual cost of power from the 300,000-hp. development will be $14.30 per horsepower. Adding additional allowances for contingencies and reserves, as considered requisite by the investigating commission, the cost will be $14.85 per horsepower.

For the full development of 550,000 hp., the cost on the hydro basis will be $11.80 per horsepower, and on the basis approved by the investigating commission $12.55 per horsepower. If the Queenston-Chippawa development had been built for $11,000,000 less, the price of power would have been affected to the extent of $1.80 per annum.

I. E. C. Committee Elected

Dr. C. H. Sharp Succeeds Dr. C. O. Mailloux as the Head of United States National Group

AT THE meeting of the council of the International Electrotechnical Commission held in Paris on December 3 last Dr. C. O. Mailloux, who had been president of the commission since 1919, retired and was succeeded by Guido Semenza of Milan. Subsequently, in view of his distinguished services for the commission, Doctor Mailloux was elected honorary president of the commission. These elections were reported by cable to the ELECTRICAL WORLD at the time. Other general officers of the commission were also elected at the Paris meeting.

The International Electrotechnical Commission is represented in this country by the United States National Committee of the International Electrotechnical Commission, of which Doctor Mailloux was president also. The constitution of the national committee provides that the terms of all appointed members of the committee shall expire whenever the international commission holds a general election of officers. Therefore the organizations represented on the national committee were requested to make new nominations for its membership. These organizations responded, and by their action the committee is now composed as follows:

Representing American Institute of Electrical Engineers—C. A. Adams, J. J. Carty, L. W. Chubb, W. A. Del Mar, Gano Dunn, H. W. Fisher, H. M. Hobart, D. C. Jackson, A. E. Kennelly, B. G. Lamme, C. O. Mailloux, F. V. Magalhaes, A. S. McAllister, A. H. Moore, F. D. Newbury, L. T. Robinson, D. W. Roper, Charles F. Scott, C. E. Skinner, Elihu Thomson, R. B. Williamson, C. H. Sharp; ex-officio, H. J. Ryan, G. L. Knight, H. S. Osborne.

Representing Electrical Manufacturers' Council.—Nominated by Associated Manufacturers of Electrical Supplies: C. A. Bates, LeRoy Clark, R. W. E. Moore, H. R. Sargent; nominated by Electric Power Club: James Burke, C. L. Collens, 2d., A. L. Doremus, A. E. Waller.

Representing American Society for Testing Materials—C. L. Warwick.

Representing National Electric Light Association—L. L. Elden, George H. Harries, S. G. Rhodes.

Representing American Engineering Standards Committee—P. G. Agnew.

Representing Department of Commerce.—R. A. Lundquist.

Representing Bureau of Standards.—Dr. G. K. Burgess.

Representing Navy Department.—Lieut.-Com. C. S. Gillette, Bureau of Engineering.

Representing War Department.—Major-Gen. C. McK. Saltzman, Chief Signal Officer.

The committee so organized held its first meeting on March 12 and completed its organization by the election of officers and of its executive council. Doctor Mailloux, who had served the committee with the utmost fidelity and success for a long period of years, since the retirement of the late Prof. F. B. Crocker from the presidency, signified his desire of being relieved of the burden of that office, and the committee with great regret acceded to his wish. Thereupon Dr. C. H. Sharp was elected president of the committee, and immediately thereafter Dr. C. O. Mailloux was, by unanimous resolution, elected honorary president of the committee and ex-officio member of the council and of all sub-committees. In making this appointment the committee wished, by following the precedent set by the International Electrotechnical Commission, to express its recognition of the unselfish, untiring and effective services of Doctor Mailloux, which have been devoted no less to the United States National Committee than to the international body. The committee furthermore hopes in this way to retain the advantage of Doctor Mailloux' counsel and advice, which, seasoned by long contact with the whole movement from its inception in 1906, the committee feels to be invaluable.

Prof. D. C. Jackson and James Burke were re-elected vice-presidents, and S. G. Rhodes was elected secretary and treasurer. As members of the executive council there were appointed from the American Institute of Electrical Engineers' group L. T. Robinson, D. C. Jackson and C. E. Skinner, and from the other group of appointed members James Burke, A. L. Doremus and C. A. Bates.

The Institute of Radio Engineers was invited to become affiliated with the United States National Committee and appoint delegates to it.

It was announced that meetings would be held in London on July 15, 16 and 17 of the advisory committees on rating of electrical machinery, on nomenclature and on graphical symbols of the I. E. C., and the executive council was authorized to nominate delegates to these meetings.

Underground Transmission at 66 Kv.

New Subway Cable of Cleveland Company, Crossing City, Will Be Operated at High Tension—Interconnected System Extends from Lake to Windsor, W. Va.

SUCCESSFUL tests of the highest-voltage cable as yet constructed in America for underground transmission of electricity were announced last week by the Cleveland Electric Illuminating Company. This cable is laid in a subway which crosses the city of Cleveland, extending 8¼ miles, and connects the company's power plant at East Seventieth street and Lake Erie with the company's overhead high-tension transmission line beginning at the city limits. The overhead line continues 12½ miles to the Cuyahoga-Summit County border, where it ties in with the system of the Northern Ohio Traction & Light Company. This system in turn ties in with the system of the Ohio Power Company, making a complete superpower connection between Lake Erie and the Ohio River.

The cable will carry 66,000 volts, which is a pressure 50 per cent higher than that of any other existing underground cable in America. It has been tested with 152,000 volts direct current, a pressure greatly in excess of what it will be required to carry in regular service, and it has withstood this test without a flaw.

HIGH VOLTAGE ACROSS CITY

The development of this 66,000-volt cable grew out of the necessity for transmitting current at high voltage across the city to supply the southerly part of Greater Cleveland and to connect with the system of the Northern Ohio Traction & Light Company, which serves Akron and adjacent territory. Because of the conditions usually found in any congested metropolitan area it was desirable to use an underground transmission system rather than an overhead system. Likewise, because even the ground underneath the city is congested with other electric and telephone conduits, water mains, sewers and other construction, it was desirable to build a subway occupying as little space as possible.

This underground transmission system, as built, contains two three-phase circuits. The amount of power which can be transmitted over either one of these circuits without overheating the cable is in the neighborhood of 30,000 kw. To transmit an equal amount of power at the pressure of 11,500 volts at which it is generated at the Lake Shore station would require ten cable circuits, and even with this greater number the efficiency and voltage regulation would not be so good.

The subway system receives current through transformers which increase the voltage to 66,000. At the end of the subway system the current is stepped up to 132,000 volts, at which it will be carried overhead to Akron. The superpower system extends from the Lake Shore station of the Cleveland Electric Illuminating Company on Lake Erie to the power plant of the Ohio Power Company at Windsor, W. Va., on the Ohio River. Power can be transmitted over this system in either direction.

Cooper Likely to Get White River Permit

The Hugh L. Cooper Company has formally requested the Federal Power Commission to take up for immediate consideration its application for a preliminary permit covering three sites on the White River in Arkansas. In view of the fact that the Cooper company is acting in this matter for the North American Company, which apparently, because of its St. Louis interests, is in the position to make the best possible use of this power, it would seem very probable that the Federal Power Commission can do little else than grant the application.

It is understood that vigorous steps will be taken to obtain for the Dixie Power Company by congressional action a further extension of its expired preliminary permit. An amendment to the act is before the commerce committee of the Senate providing for an additional period of eighteen months to apply on that particular preliminary permit. This amendment will be opposed by the friends of the water-power act on the ground that if there is one deviation from the policy of requiring applicants to take out licenses at

the end of three years or lose their rights under the preliminary permit, the bars will be down and many sites will be tied up for indefinite periods.

Continental to Build 255 Miles of High-Tension Line

Building of three high-voltage transmission lines with a total length of about 255 miles and with at least two crossings over the Missouri River is to be undertaken this year by the Continental Gas & Electric Corporation. The most important piece of construction contemplated is a 132,000-volt or 150,000-volt steel-tower line to connect the Iowa and Nebraska properties of the Continental with its newly acquired property in Kansas City. This line will be about 175 miles in length. Several routes for it are under consideration, but none has been selected. Such a line will cross the Missouri River at least once.

A 66,000-volt line will be built from Lincoln, Neb., to Plattsmouth, Neb., a distance of 60 miles, connecting the Lincoln Gas & Electric Light Company with two other Continental subsidiaries, the Nebraska Gas & Electric Company and the Iowa Service Company. Voltage on the line from Plattsmouth across the Missouri River to Malvern, Iowa, a distance of 20 miles, will probably be raised from 33,000 to 66,000.

The Nebraska Gas & Electric Company's line from Norfolk to Tekamah, Neb., will be extended across the Missouri River to Missouri Valley, Iowa, 20 miles, to give an additional tie-in. This will be 33,000-volt construction.

Chicago Utilities Are to Buy Connecting Railroad

In order to insure a continuous supply of coal the Commonwealth Edison Company and the People's Gas Light & Coke Company, Chicago, have filed an application before the Illinois Commerce Commission for authority to purchase the Chicago & Illinois Western Railroad, operating about 12 miles of track on the outskirts of the city. This railroad has a direct or indirect connection with all railroads in Chicago and will provide a direct means of transporting coal from the main-line roads to the Crawford Avenue station of the Commonwealth Edison Company, ultimately to have a capacity of 600,000 kw., and also the Crawford Avenue plant of the Chicago By-Products Company, which supplies the gas company.

The petition states that, subject to the approval of the commission, the companies have agreed to purchase all the outstanding capital stock of the railroad company for the sum of $204,500 and certain demand notes aggregating $650,000 for the sum of $516,000. The railroad has outstanding $959,000 general mortgage 6 per cent gold bonds. In view of the fuel requirements of the Crawford Avenue plant, which will total 3,000,000 tons annually, the petition says, it is a matter of public convenience and necessity that the Commonwealth Edison Company be provided at all times with adequate railroad facilities.

Public Service Financing

New Jersey Corporation Plans to Unite Electric and Gas Subsidiaries and Exchange Issues

THE Public Service Corporation of New Jersey, through its president, Thomas N. McCarter, has announced a plan for a complete readjustment of the corporation's financial structure as affecting certain securities and intercompany relations. The plan has been submitted to the New Jersey Board of Public Utility Commissioners. As summarized by Mr. McCarter it provides:

1. For the consolidation of the Public Service Electric Company, Public Service Gas Company, United Electric Company of New Jersey and several smaller companies, practically all of whose stocks are now owned by the Public Service Corporation, into a new company, to be known as the Public Service Electric & Gas Company, all of whose common stock will be owned by the Public Service Corporation.

2. For the exchange of $19,736,800 common stock (limited to 5 per cent dividends) of United Electric Company for $19,736,800 of 6 per cent preferred stock of the Public Service Electric & Gas Company.

3. For an offer to the holders to exchange the $31,978,000 general mortgage 5 per cent bonds of the Public Service Corporation outstanding in the hands of the public for $31,978,000 first and refunding mortgage 5½ per cent bonds, series due 1959, to be issued under a mortgage to be made by the Public Service Electric & Gas Company.

4. For the redemption of the outstanding $9,500,000 twenty-year 7 per cent secured gold bonds of the Public Service Corporation due December 1, 1941, in order that $14,000,000 general mortgage 5 per cent bonds of the Public Service Corporation pledged thereunder may be released and canceled.

5. For an offer to the stockholders of certain other gas and electric companies leased to the corporation to exchange their stocks for other securities, so that eventually these companies also may be consolidated with the Public Service Gas & Electric Company. These consolidations are not, however, an essential part of the plan.

NEEDS OF THE CORPORATION

In a circular accompanying the notice of the company's new financial plans Mr. McCarter said:

"The tremendous activity of the corporation's operating subsidiaries requires each year great amounts of capital for the development of the properties, which must be made to provide adequate service to the public and properly to protect and perpetuate the business. In 1924, for example, expenditures aggregating approximately $34,000,000 will have to be made to these ends. The present financial structure of the system is not such as to accomplish this purpose to the best advantage. When it took shape over twenty years ago the enormous growth of the public utility business could not have been foreseen.

"The corporation's preferred and common stockholders will be greatly benefited by the internal rearrangement of finances which the plan contemplates, because it provides adequate and satisfactory avenues for future financing and for the procuring of new capital on terms which are more favorable than can be obtained under the present structure and which are essential to protect and improve the stockholders' interests."

California Power Board Is for Trinity River Diversion

The California Power Board, which was created last year at the instance of the Federal Power Commission, has reported that the Trinity River in California should be diverted into the Sacramento Valley. The report finds that the point of diversion should be just below the mouth of Stuart's Fork. The reasons against the diversion, the report says, are outweighed by its advantages. It is pointed out, however, that the present demands for power and for irrigation are not sufficient to justify the diversion at this time.

The immediate diversion of the stream is proposed in an application for preliminary permit which has been submitted to the Federal Power Commission by W. H. Samson of Corning, Cal. In view of the report, it is probable that the Samson application will be denied and that both the state and the federal government will adopt a policy of granting no rights on the Trinity, or on the Klamath below the mouth of the Trinity, which would block the future diversion of the Trinity into the Sacramento Valley.

Oklahoma Association Favors Indeterminate Permit

Before its adjournment on Thursday, March 13, the Oklahoma Utilities Association, whose early sessions at Oklahoma City were reported last week, passed a resolution favoring the granting of local franchises on a basis of the indeterminate permit, or franchise that does not specify a limited number of years to run. The advantage of such a permit, utility men pointed out, is that a public service company under its provisions is in a position to retain its territory as long as it gives adequate service. Under the present plan companies sometimes quit making extensive repairs and cease building operations about five years before the expiration of a franchise because they cannot be assured that it will be renewed.

Another resolution asked that the state educational department be asked to co-operate with the association in establishing utility education courses in the state universities and colleges.

Much time was given to discussing the farmer's need of cheap electric power. An address on this subject by Charles F. Stuart, assistant vice-president and general manager of the Northern States Power Company, Minneapolis, was read by F. J. Meyer, Oklahoma Gas & Electric Company, and received with enthusiasm.

Officers for the ensuing year were elected as follows: President, J. W. Walton of the telephone division; vice-presidents, R. C. Sharpe and F. B. Hathaway; treasurer, W. R. Emerson; manager, Edward F. McKay.

Canada's Central Stations

Official 1922 Statistics Show Output of Six and Three-Quarter Billion Kilowatt-Hours

A PRELIMINARY report on the central-station industry of Canada for 1922, recently issued by the Bureau of Statistics at Ottawa, records a total output of electrical energy of 6,740,750,000 kw.-hr., compared with 5,614,132,000 kw.-hr. in 1921. The total capital investment had increased from $484,669,451 to $568,068,752 and the total number of stations from 857 to 905, divided as follows: Hydro-electric, 269; fuel-burning, 253; non-generating, 383. The immense disproportion existing in Canada between water-generated and steam-generated energy is shown by the fact that waterwheels and turbines are rated at 2,112,289 hp., steam turbines at 89,545 hp., steam reciprocating engines at 40,484 hp. and gas and oil engines at 16,080 hp. This is exclusive of 1,736,199 kva. in secondary power.

OUTPUT AND REVENUE BY PROVINCES

	Thousands of Kw.-Hr. Generated	Revenue
Alberta	122,568	$3,100,685
British Columbia	522,675	7,567,964
Manitoba	262,625	3,397,610
New Brunswick	37,009	1,357,772
Nova Scotia	36,910	2,159,439
Ontario	3,151,460	40,400,551
Prince Edward Island	1,368	115,705
Quebec	2,539,874	21,514,289
Saskatchewan	57,624	2,596,769
Yukon	8,637	118,082
Total	6,740,750	$82,328,866

Revenue totaled $82,328,866 as compared with $73,376,580 in 1921, and operating expenses $49,962,644 as compared with $47,044,503. The net increase in installed power in 1922 was 280,541 hp. in main plants and 17,704 hp. in auxiliary plants. The average number of private houses using electricity was 9.92 per hundred of population as against 9.44 in 1921. British Columbia ranks first in this respect with 14.41, Ontario second with 12.06, Quebec third with 11.20 and Manitoba fourth with 9.55.

More Light and Power Company Reports for 1923

The Kansas City Power & Light Company's annual report for the year ended December 31, 1923, contains the following figures, the comparison being with the preceding twelve months in each instance: Gross earnings, $8,861,985 against $7,887,328; operating expenses and maintenance, $3,742,771 against $3,701,922; balance for dividends after deductions, $2,123,175 against $1,615,434; surplus, $423,175 against $880,070.

The Montana Power Company and subsidiaries in 1923 earned, after deduction of taxes, charges and depreciation, $3,067,752, compared with $2,556,732 in 1922. Gross earnings increased 11 per cent over 1922, due to larger operations in the mining and smelting industries and gradual increase of general business. The increase in operating expenses amounted to about $112,000.

The Wisconsin Power, Light & Heat Company, Madison, had for 1923 gross earnings, including merchandise sales, of $1,132,345 compared with $884,016 in 1922. After deducting operating expenses, taxes, interest and dividends of $69,448 there remained a surplus of $122,680.

The Potomac Edison Company's 1923 report shows gross earnings of $3,630,199, an increase of $457,635 over the preceding year, while net income available for dividends was $501,198, an increase of $194,686.

The Indianapolis Light & Heat Company had total operating revenues in 1923 of $4,505,323, total operating expenses, depreciation, contingencies and taxes of $3,565,202, net operating revenue of $940,110 and a surplus for the year of $991,216, including adjustments of $197,676.

The Merchants' Heat & Light Company of Indianapolis had net operating revenue for 1923 of $727,718, a net income of $244,322 and a surplus of $1,269,296, including adjustments of $774,214, resulting mainly from increased valuation.

Pacific Gas Enters Contract with Irrigation District

An agreement of importance to both the hydro-electric and the agricultural progress of California has just been entered into between the Pacific Gas & Electric Company and the Nevada County Irrigation District for the development of irrigation water in Nevada County and has received the sanction of the California Railroad Commission, which was an active agent in its negotiation. The terms of the contract make possible the development of more than 140,000 acre-feet of water for irrigation and will involve the expenditure of $8,000,000 by the company and the district in water and hydro-electric power works.

The development will be on the south and middle forks of the Yuba River, from which water will be diverted through Lake Spaulding and power plants of the Pacific Gas & Electric Company and then returned to the Nevada County Irrigation District for use in Nevada County. The central-station company will pay to the district for water diverted $2 per acre-foot at its Deer Creek power house and $3.50 at its Drum power house, and for power to be developed in a plant to be built by the company above the Spaulding reservoir the company will pay the district 1 mill per kilowatt-hour generated. The total revenue to be received by the district from the company will be approximately $375,000 a year. The district will buy from the company at a price to be determined by the Railroad Commission its water distribution system in Nevada County.

By this agreement not only will a new power resource be gained, but an enormous area of agricultural land will be rendered fertile.

Suggests Black or Mojave Canyon

R. H. Ballard Supplements His Congressional Testimony by Pointing Out How Flood Control and 300,000 Hp. of Energy Can Be Had Without Boulder Dam

DECLARING that flood control is the primary requirement on the Colorado River, that it may be accomplished in two or three years under a co-ordinated general plan where sale of power would pay the cost, that the expense of the proposed Boulder Canyon Dam—officially estimated at $55,000,000 for the dam and $49,000,000 for generating and transmitting 600,000 hp. of electrical energy—is far too great and would pile up a deficit of $52,000,000 in the first fifteen years, and that this plan would besides leave the Imperial, Coachella, Palo Verde and Yuma Valleys in continued danger during the eight or ten years it would take to build the dam, R. H. Ballard, vice-president and general manager of the Southern California Edison Company, issued a statement last week supplementing his testimony before the irrigation committee of the House of Representatives (see ELECTRICAL WORLD, March 15, page 540). In this statement Mr. Ballard contends that a dam slightly more than 300 ft. high would provide 5,000,000 acre-feet of storage, or enough with the existing works to control floods, at either Glen Canyon, in the upper basin or near Boulder Canyon, in the lower basin, and a dam at Topock, in Mojave Canyon, a little over 100 ft. in height would provide this storage and control the floods at much less cost. Mr. Ballard continues:

"Complete development of water for irrigation purposes would not be needed at the start. Fifteen years at least must elapse before the development of all lands requiring irrigation water in the lower basin could take place. Electric power development may be augmented beyond that strictly incident to the construction needed for flood control, for the purpose of increasing the revenue, but an initial development beyond 300,000 hp. will result in annual deficits by reason of the lack of an adequate power market to absorb more than this amount of energy.

SITE AT BLACK CANYON

"An interesting suggestion has been made that a dam 310 ft. high, near Black Canyon, in the same general vicinity as Boulder Canyon, would sufficiently control the floods with a storage of 4,000,000 acre-feet of water. At this site 300,000 hp. of electrical energy could be developed at an estimated cost of $104.30 per horsepower, including the cost of the dam, but without the cost of transmission lines, which would raise the figure to about $145 per horsepower. This low cost compares favorably with the latest development of my own company and is very much less than the $273 per horsepower

cost under the high-dam plan for the amount of power the market could absorb without incurring annual deficits.

"At the Diamond Creek site 268,000 hp. could be developed at a cost of $112 per horsepower without transmission, and the necessary storage for flood control might be provided at Topock, in Mojave Canyon, for about one-tenth the appropriation asked for in the pending bill. This reservoir would provide secondary power to supplement the output of power plants higher up on the river. When additional reservoirs are built above Mojave Canyon, this Mojave Canyon reservoir could deliver continuous power while acting as a re-regulating reservoir.

"If the government will move along the flood-control question, the people in our own territory and the investors throughout the country are ready to finance the power development through the purchase of taxable securities of our own and other public partnership power companies. The United States would supervise and the state commissions would regulate our activities. Over 3,000,000 hp. could be developed on the Colorado River from Lee's Ferry to the Gulf of California without touching the Grand Canyon National Park. About $1,000,000 a year would be the taxes payable to the states, and an equal amount to the United States, by power companies and their security holders as a result of the first 300,000,-hp. development. Complete development would increase these tax payments to about $18,000,000 annually."

Engineers Put Boulder Dam Cost at $200,000,000

Declaring that the time has arrived for the determination of a definite government policy covering all phases of the development of the Colorado River basin, Secretary of the Interior Work this week sent a report to the chairmen of the Senate and House committees on irrigation and reclamation of arid lands covering the Swing-Johnson bill now before Congress. Accompanying it were the findings and conclusions of the select board recently appointed and composed of engineers from the Reclamation Bureau, the War Department, the Geological Survey and the Federal Power Commission, with detailed technical observations on the Colorado River problems. The Secretary urged that Congress in its final decision upon a plan of development for the river consider all the separate features in the light of the report, including flood control, impounding water for farming, storing water for generating electric power, the projected all-American canal and the possible future necessity for domestic water to supply California cities.

The total cost of the dam, the power plant and transmission lines and the canal should, he said, be estimated at $200,000,000, which includes a margin of safety to protect the government. Of this sum the dam itself, which would raise the water surface 605 ft. and create a reservoir 120 miles long and 157,000 acres in area, will cost about $50,000,000 and the canal $31,000,000.

Secretary Work expressed doubt as to the wisdom of the government's consenting to the erection by private enterprise or of itself proceeding to erect any storage dam in the Colorado before the seven-state treaty shall have been signed by Arizona. On the question of the generation of electric power by the government he said:

"The generation of electric power by the government under any conditions is precarious financial practice. The manufacture of it primarily for sale on the open market, in competition, invites subsidies and is without congressional sanction at this time. The government, instead, may exercise its authority to fix rates to consumers for their protection."

The engineers' report submitted by Secretary Work, which is favorable to the Boulder Canyon site, contains separate reports by the Bureau of Reclamation, by Herman Stabler of the Geological Survey and by Col. William Kelly, chief engineer Federal Power Board. Colonel Kelly says that about 150,000 hp. could be produced at the Mojave site and that a reservoir of 4,000,000 acre-feet would provide a satisfactory solution of the flood problem.

Arthur B. West, president of the Southern Sierras Power Company, Riverside, Cal., testifying on Wednesday before the House committee, declared the flood menace had been exaggerated, opposed the canal project and said that the building of reservoirs and water plants could "be best committed to private enterprise under some plan such as is proposed by the Southern California Edison Company, which, while retaining government control and supervision, will wholly relieve the government and the territory to be benefited from all expense in connection with the project."

Ferguson Tells How Interconnection Helps Railroads

"The development of interconnection and operation of more efficient central stations are relieving congestion of traffic on New England railroads and improving economic conditions in electrical supply generally," said Samuel Ferguson, president of the Hartford Electric Light Company, on Tuesday in addressing the Hartford Engineers' Club upon the manufacture and distribution of hydro-electric power. In steam-plant operation four years ago, the speaker said, the Dutch Point station at Hartford was the most efficient in Connecticut, utilizing 13.5 per cent of the fuel energy in electrical production. The new South Meadow station in that city utilizes 17 per cent of the fuel energy, and the mercury boiler and turbine installation in experimental service at Hartford is turning about 30 per cent of the fuel energy into electricity and high-pressure steam. This gain in steam-plant efficiency in four years has already brought about a saving now rated at a thousand carloads of coal per year. Mr. Ferguson pointed out that interconnection and plant development point the way toward relieving the railroads of the East of hauling a large volume of low-revenue, bulk-commodity freight, increasing useful transportation facilities and tending to raise the credit standing of the carriers.

Electrical Topics at Illinois State Convention

Public utility information work will be discussed by J. F. Gilchrist and B. J. Mullaney at joint sessions of the fourth annual convention of the Illinois State Electric Association, Illinois Electric Railway Association and Illinois Gas Association, which will be held at the Hotel Sherman, Chicago, on March 26 and 27. M. H. Aylesworth and B. I. Budd will speak, and central-station service versus isolated-plant power will be the subject of a paper by A. C. Hall.

One of three parallel sessions on Wednesday and Thursday afternoons will be devoted to the electric division of the association. Among the topics will be the value of lighting service and of electric range loads from the central-station viewpoint, discussed by J. M. Shute and C. O. Dunten respectively; suggestions for putting rural service into effect with proper rates, by B. H. Peck; superpower and interconnection within Illinois, by R. F. Schuchardt; practices of foreign utilities, by B. G. Jamieson, and communications to customers, by D. H. Howard.

Eastern Electragists Convene at New York

Evils in the electrical equipment distribution system involving such destructive practices as the granting of wholesalers' discounts to those doing retail business and of contractors' trade prices to purchasers incapable of installing the equipment themselves were uncovered in a report read by W. Creighton Peet, chairman of the merchandising policy committee, before the convention of the Eastern Division, Association of Electragists International, on March 18 at the Hotel McAlpin, New York City.

On March 17 sessions of the association's executive committee were held. On March 18 the union-shop and open-shop sections, Eastern Division, also held sessions. Both sections discussed matters of section organization.

President James R. Strong of the international association presided at the afternoon session. The program consisted of speeches followed by open discussions. Mr. Peet's report, which because of his absence in Central America was read by Laurence W. Davis, secretary of the association, opened the session. In a talk on the National Electrical Code A. Penn Denton of Kansas City, chairman of the association's code committee, urged that local contractor organizations refuse to permit test installations of equipment not up to code standards. Other talks included "The Electragist," by Joseph G. Crosby, Philadelphia, chairman of the publication committee, and "Co-operation in California," by Clyde L. Chamblin, San Francisco, Pacific Division executive committeeman. P. B. Zimmerman, National Lamp Works, Cleveland, outlined plans for a national lighting educational campaign.

Joseph A. Fowler of Memphis, Tenn., executive committeeman from the Southern Division, was the speaker at the evening dinner.

Briefer News

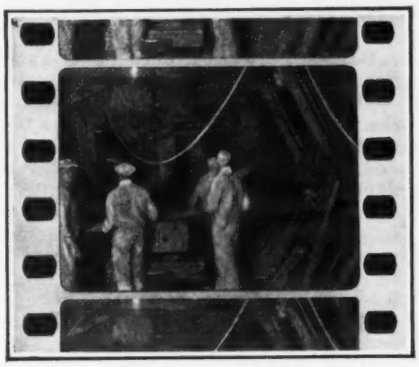
Oklahoma Central-Station Company to Use Radio Dispatching.—The Oklahoma Gas & Electric Company is installing a radio load dispatching system at a cost of $27,000 to serve Oklahoma City, Enid and Sapulpa. With an antenna 3,000 ft. long strung parallel to the transmission lines, messages will not be received more than 100 ft. from the high-voltage line, thereby avoiding infraction of the present government radio regulations.

Competition at Spartanburg, S. C.—The Blue Ridge Power Company of Hendersonville, N. C., which has hydro-electric developments on Green River, has leased offices and a storeroom in Spartanburg, S. C., and will, it announces, sell energy as well as electrical equipment in that city. The company is largely financed by Spartanburg capital. Spartanburg's central station is that of the South Carolina Gas & Electric Company, and it is also reached by the lines of the Southern Power Company.

Judge Appleton to Speak on Public Relations.—At a Public Relations Section meeting of the New England Division, N. E. L. A., at the Providence-Biltmore Hotel, Providence, R. I., March 25, Judge C. W. Appleton, general counsel General Electric Company, will speak upon "The Economic Value of Public Relations Work." There will be a luncheon at 12:30 p.m. prior to the address.

Pacific Coast Electrical Jobbers Meet.—The annual meeting of the Pacific Coast Division, Electrical Supply Jobbers' Association, was held at Del Monte, Cal., on March 6-8. R. J. Holterman, manager of the San Francisco office of the Fobes Supply Company, was elected chairman for the coming year and Albert H. Elliot was reappointed secretary. C. T. Hutchinson and W. V. Woehelke addressed the open meeting on the responsibility of periodicals and trade papers to their readers.

Electricity Tunnels the Hudson.—The film here reproduced is one belonging to a motion picture taken by the Visugraphic Pictures, Inc., to illustrate the construction of the tunnel for vehicles now being excavated under the Hudson River between New York City and the New Jersey side. These scenes are



to be a part of the pictorial history of the Public Service Corporation of New Jersey as well as a record of its activities throughout the state. This company not only furnishes the power to operate the large power house of the contractor, where air compressors are continuously at work (47 lb. pressure being necessary to keep the earth from falling in on the "groundhogs"), but it also supplies the energy which operates the narrow-gage railroad conveying the excavated earth to the surface and all that is required for elevators, lamps, electric shovels, cranes and other purposes.

Jersey Central Power & Light Will Buy Long Branch and Pompton Lakes Utilities.—The Jersey Central Power & Light Corporation, an A. E. Fitkin holding company, plans to acquire the Consolidated Gas Company of New Jersey, which does an electric light and power business in Long Branch, N. J., and neighboring places, and the Tri-County Electric Company of Pompton Lakes, N. J., serving also Bloomingdale and seven other towns. The Jersey Central Power & Light Corporation is floating securities for the purpose named.

Survey of Wisconsin Transmission Systems.—An extensive survey of power-transmission systems in Wisconsin is being prepared by the engineering department of the State Railroad Commission, and a map of all lines is being prepared. The survey will be completed before the end of March, it is expected. When the information shall have been compiled and the map completed, it will show the general direction of all transmission lines of 2,300 volts or more which connect one community with another.

Growth of Coos Bay Territory in Oregon.—Construction work will be started soon by the Mountain States Power Company on a 6,700-hp. steam generating station at North Bend, Ore., to provide for the steadily growing power needs of the territory served by the Coos Bay division of the company. In five years the output of electrical energy in this territory has increased 163.89 per cent. In addition to North Bend this division serves Marshfield, on Coos Bay, one of the few deep-sea harbors between San Francisco and the Columbia River, and other communities. The new plant will cost about $650,000.

Fight Waged Over Coosawattee River Site.—An injunction sought by the Washington Land Company to prevent the condemnation of lands on the Coosawattee River in Gilmer County, Ga., for the purpose of developing the

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations is published in the first issue of each volume. See January 5 issue, page 72, for latest list.]

Illinois State Electric Association—Hotel Sherman, Chicago, March 26-27. R. V. Prather, Springfield, Ill.

Southern Appalachian Water Power Conference — Chattanooga, Tenn., March 26. J. A. Switzer, Knoxville, Tenn.

Association of Iron and Steel Electrical Engineers — Fuel-saving conference, William Penn Hotel, Pittsburgh, April 2 and 3.

American Institute of Electrical Engineers—Spring convention, Birmingham, Ala., April 7-11. F. L. Hutchinson, 33 West 39th St., New York.

American Society of Civil Engineers—Atlanta, April 9-12.

Middle West Division, N. E. L. A.—Kansas City, Mo., April 9-12. H. M. Davis, Bankers' Life Bldg., Lincoln, Neb.

Missouri Association of Public Utilities—Kansas City, April 10-12. F. D. Beardslee, 315 North 12th St., St. Louis.

Southeastern Water and Light Association—Piedmont Hotel, Atlanta, April 15-17. W. F. Steiglitz, Columbia, S. C.

Wisconsin Utilities Association—Hotel Pfister, Milwaukee, April 17-18. J. N. Cadby, 445 Washington Bldg., Madison.

Southwestern Division, N. E. L. A.—Hotel Grunewald, New Orleans, April 22-25. S. J. Ballinger, San Antonio, Tex.

Southwestern Public Service Association—New Orleans, April 22-25. E. N. Willis, Dallas, Tex.

American Electrochemical Society—Hotel Bellevue-Stratford, Philadelphia, April 24-26. C. G. Fink, Columbia University, New York.

American Physical Society—Washington, April 25-26.

Rocky Mountain Division, N. E. L. A.—Cheyenne, Wyo., May 5-6. O. A. Weller, 900 15th St., Denver.

Wyoming Utilities Association—Cheyenne, May 5-6. H. C. Chappell, Casper, Wyo.

Nebraska Section, N. E. L. A.—Omaha, May 8-9. H. M. Davis, Bankers' Life Bldg., Lincoln.

Pacific Coast Electrical Association—Hotel del Coronado, San Diego, Cal., May 17-20.

National Electric Light Association—Atlantic City, N. J., May 19-23. M. H. Aylesworth, 29 West 39th St., New York.

National Electrical Credit Association—Chicago, May 22-23. F. P. Vose, 1347 Marquette Bldg., Chicago.

Electric Power Club — Seaview Golf Club, Absecon, N. J., May 26-29. S. N. Clarkson, B. F. Keith Bldg., Cleveland.

Electrical Supply Jobbers' Association—Homestead Hotel, Hot Springs, Va., June 4-6. Franklin Overbagh, 411 South Clinton Street, Chicago.

Pacific Coast Electrical Association—Hotel Coronado, Coronado, Cal., June 17-20. S. H. Taylor, 527 Rialto Bldg., San Francisco.

American Institute of Electrical Engineers — Annual convention, Edgewater Beach (Chicago), June 23-27. F. L. Hutchinson, 33 West 39th St., New York.

Associated Manufacturers of Electrical Supplies—Hotel Ambassador, Atlantic City, N. J., June 24-27.

Society for the Promotion of Engineering Education—University of Colorado, Boulder, Col., June 25-26. F. L. Bishop, University of Pittsburgh, Pittsburgh.

hydro-electric project promoted by N. P. and G. L. Pratt which has already been alluded to in this column (March 1, page 497) has been denied in the Circuit Court. The defendants sought to show that the Washington Land Company was controlled by the Georgia Railway & Power Company and that the object sought in the legal proceedings was to bar out a competitor with that company in water-power development. This was denied by the land company, which will file exceptions.

S. E. D. Issues Aid to Sales in 1924.—Among recent publications of the Society for Electrical Development is a forty-page pamphlet entitled "Plans for Your 1924 Sales Program," in which the wide range of "selling helps" and other services available from the society is cataloged. Included in the publication are suggestions for commodity, electric home and special campaigns offered as a basis of sales activities. The society's literature on radio, house wiring, electrical appliances of every description, store, commercial and residence lighting, electric trucks, market possibilities, news and feature services, poster advertising and other things is listed and explained, and there are comments on massing individual effort and on the conferences of electrical leagues.

Colorado Springs Election Set for May 6.—May 6 has been set tentatively as the date for a special election in Colorado Springs to vote on a bond issue for a municipal lighting plant. There are alternative propositions—one to serve Colorado Springs only at a cost of $1,004,778, the other to serve nearby communities as well at a total cost of $1,252,778. Manitou will probably be taken care of in any event in return for a right-of-way for a transmission line across its southern border. The engineer's report insists on the necessity for a steam plant. Litigation with the Colorado Springs Light, Heat & Power Company, to which a franchise renewal was refused, will probably cause a long delay before the situation is cleared up, and it is still possible that the municipal venture may be called off.

Southern Power to Raise Wateree Dam.—A contract representing an outlay of $250,000 has been let by the Southern Power Company for work on its Wateree hydro-electric dam in lower South Carolina. The dam is to be raised 6 ft. It is at present 1,700 ft. long and averages about 75 ft. in height. The new work is not intended to increase the output of electrical energy of the plant at Wateree, but to steady its efficiency by impounding a greater volume of water. The dam at present backs water for a distance of 24 miles and impounds an area of 11,500 acres. It was completed about two years ago and is one of the big units in the Southern Power system.

Stone & Webster Offer in Columbia (S. C.) Litigation Refused by State Authorities.—The South Carolina Canal Commission, in a report to the Legislature, has refused an offer from Stone & Webster of $200,000 in compromise of pending litigation over the obligation of the Columbia Railway, Gas & Electric Company to complete the Columbia Canal preparatory to generating hydro-electric energy at the confluence of the Broad and Saluda Rivers. Stone & Webster hold an option on the Columbia company properties which they were willing to exercise if the state would compromise its differences with the company, the offer of $200,000 being in settlement of all claims of the state. The Canal Commission reported that the Stone & Webster Company did not give any guarantees as to when developments would start if the engineering firm got the property. The commission also held that acceptance would be a surrender by the state of its rights in the Columbia Canal and the electric power to be developed for the state's own needs.

Contest Between Riparian and Water-Power Interests in Wisconsin Adjusted.—The fight which has been waged in the Fox River Valley, Wisconsin, for more than fifty years between riparian and water-power interests has in all likelihood been determined following an agreement entered into by these two interests and the federal and state governments. The compact provides for the abolishment of the high-water levels which have been the bone of contention, causing annual flood menaces with consequent damage to adjoining property. Request has been made by the War Department to the Association for the Relief of High Water and the combined water-power interests that they prepare an agreement and draw up legislation to lower the Menasha Channel. The completed report will be submitted for the approval of the rivers and harbors committee at Washington by a joint committee of water-power and riparian interests.

Municipal Plants Disappearing in Michigan.—During 1923, according to data just received by the Michigan Public Utility Information Bureau, more than a score of municipal electric plants were abandoned in favor of service from central-station lines that would meet all demands and permit twenty-four-hour use. At least as many more had suffered the same fate in the two or three years immediately preceding. Most of the plants abandoned were worn out or their distribution systems had been outgrown. In almost every case the municipality had provided no depreciation or maintenance fund, and the bond issues whereby these plants were first financed were still outstanding in whole or in part. Moreover, it was established that the isolated power plants could not compete in costs and rates with the larger systems, which had taken advantage of recent scientific and engineering developments in the serving of energy. In nearly every instance the change in service called for a public referendum requiring three-fifths majority on two propositions—one to discontinue existing service, the other to ratify a working agreement with the organization which was to supply energy in the future.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

William A. Jackson, who has been at the head of the legal department of the Milwaukee Electric Railway & Light Company for the past nine years, has been appointed a vice-president of the company. Before becoming associated with the Milwaukee company Mr. Jackson had been identified with the North American Company in Chicago.

Norman R. Gibson, hydraulic engineer of the Niagara Falls Power Company, has been made manager of the Niagara Falls office of Harper & Taylor, Inc. Mr. Gibson was previously on the engineering staff of the Ontario Power Company of Niagara and has been identified with many hydro-electric projects in Canada.

F. W. Laas has been appointed chief engineer of the new high-pressure superpower station now being constructed at Valmont, Col., by the Public Service Company of Colorado.

N. H. Coit, for the past eight months assistant commercial manager of the Pennsylvania Edison Company, Easton, Pa., has been transferred to the Florida Public Service Company at Orlando, recently purchased by the W. S. Barstow Management Association, Inc., which also operates the Pennsylvania Edison Company. Before moving East to enter the service of the Pennsylvania utility Mr. Coit was affiliated with the Western Public Service Company, Auburn, Neb., as superintendent.

H. W. Bromley, formerly superintendent of power of the Pennsylvania-Ohio Electric Company with headquarters at Youngstown, Ohio, has resigned. Mr. Bromley has been associated with the company for more than ten years.

W. J. Wilkinson, who formerly was associated with the Nebraska Power Company, Omaha, where he engaged in illumination work, has been made division manager for the newly organized Minnesota Power & Light Company of Duluth, with headquarters at Cloquet, Minn.

H. S. Crosswhite, formerly superintendent of distribution in the Wichita district of the Kansas Gas & Electric Company, has been transferred to the Independence district as superintendent of the Elk River division. Mr. Crosswhite has been identified with the company since 1920, when he joined its forces at Frontenac. Subsequently he was transferred to the Pittsburg (Kan.) office, and in 1922 he went to Wichita to take charge of substations and transmission lines.

Dr. Sharp Heads United States Committee of I. E. C.

Dr. Clayton H. Sharp, technical director of the Electrical Testing Laboratories, New York, was, as announced elsewhere in this issue, elected president of the United States National Committee of the International Electrotechnical Commission at the committee meeting held on March 12, succeeding Dr. C. O. Mailloux, resigned. Dr. Sharp has long taken a prominent part in the work of the International

C. H. SHARP

Electrotechnical Commission as a member of the United States committee and for many years has been an outstanding figure in the field of illuminating engineering. He was one of the founders of the Illuminating Engineering Society, which he has served in the capacity of president, and he with Preston S. Millar is co-inventor of several illumination measuring devices, including the Sharp-Millar photometer.

Dr. Sharp was graduated from Hamilton College in 1890 and took his doctor's degree at Cornell University following residence as a graduate student from 1892 to 1895. For six years he engaged in research and instructional work at Cornell with the exception of an interval of a year spent in Europe, and while abroad he did research work in the Physical Institute at Leipsic, Germany. It was in 1901 that Dr. Sharp severed his connection with Cornell University to become test officer at the Electrical Testing Laboratories, where he has since been in charge of technical work, serving also as vice-president.

Henry P. Rust has been made manager of the Philadelphia office of Harper & Taylor, Inc. Mr. Rust has long been identified with the hydro-electric field, having been associated with the Electrical Development Company, the Great Western Power Company, the Appalachian Power Company, the Northern Canada Power Company and the Northern Ontario Light & Power Company. For several years he served as engineer of plant of the William Cramp & Sons Ship & Engine Building Company, Philadelphia.

N. D. Holmes has resigned his position as chief engineer of the Farmington steam plant of the Central Maine Power Company to ally himself with the New England Power Company as operating superintendent of the Davis Bridge development near Readsboro, Vermont.

William D. Brewer, chief engineer of the Oklahoma Light & Power Company's plant at Pauls Valley, has been promoted to the position of mechanical superintendent of the company's general power plant at Byng. Mr. Brewer has been associated with the Pauls Valley plant for some twelve years under present and former ownership.

C. T. Wanzer, formerly resident engineer with the Great Falls Power Company, has been transferred to the Western Carolina Power Company, where he is resident engineer on the construction of the Rhodhiss (N. C.) development. Both these properties are subsidiaries of the Southern Power Company.

H. P. McKean, formerly engineer in the office of O. B. Coldwell, vice-president of the Portland (Ore.) Railway, Light & Power Company, has resigned to affiliate himself with L. F. Harza, consulting engineer, Chicago.

E. D. Allmendinger, manager of the foreign department of the Black & Decker Manufacturing Company, Towson, Md., sailed for England on March 15. Mr. Allmendinger will remain abroad for several weeks.

A. C. Spring, formerly associated with the International Nickel Company in the capacity of assistant electrical superintendent, has joined the staff of McClellan & Junkersfeld, engineers and contractors, New York, in the capacity of electrical superintendent on construction.

Herbert H. Skinner, formerly sales representative of the Vaile-Kimes Water Systems Company, with headquarters at Boston, has been appointed industrial gas engineer for the Kingston (N. Y.) Gas & Electric Company. Mr. Skinner is well known in New England central-station circles, his earlier career embracing a term of service as power engineer with the Narragansett Electric Lighting Company, Providence, R. I., and as Rhode Island representative of the Westinghouse Electric & Manufacturing Company.

Alton W. Leonard, president of the Puget Sound Power & Light Company, Seattle, Wash., has been elected president of the Puget Sound Electric Railway, the Tacoma Railway & Power Company and the Pacific Northwest Traction Company, subsidiaries of the Puget Sound Power & Light Company, which is a Stone & Webster property. Mr. Leonard succeeds Frederick D. Pratt, who is now chairman of the board of directors of each company. Mr. Leonard has been identified with Stone & Webster for almost thirty years, and during this period he has been in charge of the properties in Brockton, Mass.; Houghton, Mich.; Minneapolis, Minn., and since 1912 he has been associated with the Puget Sound utilities.

William Baurhyte New President in Los Angeles

William Baurhyte, vice-president and general manager of the Los Angeles Gas & Electric Corporation, was elected president of the corporation, succeeding W. B. Cline, who recently retired, as was announced in the March 15 issue of the ELECTRICAL WORLD. Mr. Baurhyte became identified with the Los Angeles company more than twenty years ago, when he assumed the duties of the second vice-presidency, which office he retained until 1913. In that

WILLIAM BAURHYTE

year he was elected vice-president. Eight years later, in 1921, he was promoted to the position of vice-president and general manager. Mr. Baurhyte is also a member of the board of directors.

Edmund D. Ayres, formerly engineer in the switchboard department of the General Electric Company, Schenectady, N. Y., is now identified with the firm of Jackson & Moreland, engineers, Boston.

Obituary

Merrill Jesse Brayton, senior vice-president Utica (N. Y.) Gas & Electric Company, died on Tuesday, March 18, in Charleston, S. C. Mr. Brayton, one of the pioneers of the electrical industry in New York State, had been identified with the electrical properties at Utica since 1889, when he joined the old Utica Electric Light & Power Company, serving as director, secretary-treasurer and general manager. When the organization was merged into the Utica Gas & Electric Company in 1902 he became a director and general manager of its electric department. Subsequently he was elected secretary and in 1920 was promoted to the position of vice-president. Mr. Brayton was one of the organizers of the Empire State Gas and Electric Association, was president last year and had served almost continuously on its executive committee since its organization. He was a native of Poland, N. Y., and was seventy-one years of age.

Commission Rulings

Service Charge for Rural Customers.—The Missouri Public Service Commission has disapproved a rule of the West Missouri Power Company providing that a service charge of $300 should be made for connecting up a farm customer if he is within one-third of a mile from any existing line and that this charge should carry with it the maintenance of the line by the utility without extra charge for a period of ten years. Under this rule, the commission held, the company would have given to it, under the guise of a service charge, the entire costs of construction of the line to the farmer and would then be the owner of the line with no obligation on its part other than maintenance for a term of ten years. The line, if well constructed, should easily last for that period, according to the commission, and at the end of that time the company could, if it so wished, impose another service charge and continue this rule *ad infinitum.*

Though Capitalization Is Not a Factor in Valuation, Investment Is.—"Existing capitalization," said the Missouri Public Service Commission in appraising the value of the St. Joseph Water Company, "is no basis for the determination of reasonable rates unless supplemented by accurate evidence as to the disposition of the proceeds of the sale of stocks and bonds outstanding. The facts relative to securities issued before regulation are so well known and the absence of any necessary relation between par value and actual investment is so notorious that we deem it unnecessary to lay further stress upon our contention that the bonds and stocks outstanding against the company's property are not indicative of either the fair present value of said property or of the investment in said property." A contention, however, that the investment is not a factor for consideration was disapproved, the commission asserting that the investment in property is an important factor for consideration in fixing the fair present value and that the United States Supreme Court had not declared reproduction cost less accrued depreciation to be either the sole or the controlling factor.

Customer Need Not Pay for Changing Location of His Service Wires.—On a petition from a customer of the Edison Electric Illuminating Company of Boston against a charge to cover the cost of changing the location of his service wires the Massachusetts Department of Public Utilities said: "The company recently supplied the premises of the petitioner from a pole on Center Street situated 100 ft. from its intersection with Ardale Street. It now becomes necessary to change the service wires from that pole to another situated at the corner of Center and Ardale Streets. The company proposes to run the new service wires when the petitioner pays in advance the estimated cost of the construction which is involved. . . . The course by which it is now proposed to supply the petitioner was open to the company at the time the supply was originally given. Although it may be that the method followed by the company for giving the supply originally was somewhat preferable from a technical viewpoint to that which has now become necessary, it is the opinion of the department that, in view of all the facts and particularly of the shortness of time between the original installation and the one now under consideration, the objection of the petitioner to the payment of the cost of changing the service wires must be sustained."

Recent Court Decisions

Company Held Responsible for Death Due to Contact of Hay Derrick with High-Tension Lines.—In Saylor vs. Enterprise Electric Company, the Supreme Court of Oregon sustained damages awarded for the death of a farmer who was killed while trying to extricate a hay derrick which had come in contact with the company's high-tension lines while being moved by horses through a gateway into the county road. The court held that the case was rightfully submitted to the jury on evidence that the company had permitted its lines to sag. The defendant had the burden of proving contributory negligence. It could not be said as a matter of law that using a pole or board to lift the wires was such negligence, and the trial court committed no error in striking from the defendant's answer an allegation that "the wires would have been killed to permit the moving of a hay derrick by decedent," it not being shown that decedent had any information on the subject. Evidence relating to the height of the wire on the sides of the gateway was admissible. (222 Pac. 304).*

Supreme Court Denies Right of Railroad to Examine Commission Data.—The United States Supreme Court has decreed, in an action brought by the St. Louis Southwestern Railway Company against the Interstate Commerce Commission, that the commission could rightly deny the complainant access to the underlying data on which its tentative valuation was based. The court expressed the opinion, however, that the commission would not refuse to give the railroad reasonable light on the way in which its figures were reached. Said the court: "The statute provides that 'unless otherwise ordered by the commission the records and data of the commission shall be open to the inspection and examination of the public.' The commission has ordered otherwise, and the order puts an end to the claim to examine the data on the naked ground that they are public documents. But as the statute provides for a hearing before the commission it does not follow necessarily that the parties to the proceeding are subject to the same rule when the data are desired as evidence. The hearing, to be sure, is not of the ordinary kind. The railroads have no adversary. The commission, of course, has no object except to arrive at the truth. It is not to be cross-examined for bias or otherwise as to its capacity to decide or modes of deciding what is intrusted to it, but, on the other hand, since it must grant a hearing, manifest justice requires that the railroads should know the facts that the commission supposes to be established, and we presume that it would desire the grounds of its tentative valuation to be subjected to searching tests."

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Supreme Court Relegates to Kansas Courts Decision on Legality of Prohibiting Coal Strikes.—The United States Supreme Court has reversed the finding of the Kansas Supreme Court in the case of August Dorchy, convicted of promoting a coal miners' strike, in order that the state court may have an opportunity again to pass upon the legality of the provision in the act setting up the Kansas Industrial Relations Court which prohibits strikes by coal miners. Since the decision of the state court upholding the constitutionality of the classification of coal mining as an essential industry affected with a public interest and declaring that strikes in coal mines were therefore legally prohibited, the United States Supreme Court has made its decision in the Wolff case holding compulsory arbitration to be illegal. The federal court of last resort now wishes the state court to reconsider its finding in the Dorchy case in the light of this principle and has announced that it will accept the decision arrived at.

Injunction Against Indiana Electric Corporation's Transmission Lines Refused.—The Superior Court in Indianapolis has refused to the Terre Haute, Indianapolis & Eastern Traction Company an injunction to prevent the Indiana Public Service Commission from issuing to the Indiana Electric Corporation a certificate of convenience to stretch high-tension power transmission lines over the right-of-way of the traction company. The decision also denied a permanent injunction against the Indiana Electric Corporation to prevent the Public Service Commission from hearing the petition of the power company for a certificate of convenience and for the granting of such a certificate. The court had previously granted a temporary restraining ordinance against the public service commission in the case (ELECTRICAL WORLD, January 19, page 156). The Indiana Electric Corporation is seeking authority to cross the traction company right-of-way at one point in Vigo County and at another point in Marion County. The plaintiff company alleged that the public service act of 1921 was unconstitutional because it delegated legislative power to the commission and because it excluded cities of the third class. This contention was declared without merit.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Maximum Service from Trade Catalogs

Importance of Content, Form, Accessibility and Classification Is Urged—Usefulness the Key Point

By Lewis A. Armistead
Librarian Boston Elevated Railway and Chairman Catalog Committee, Special Libraries Association

THE problem of making the trade catalog more useful to modern industry is one of no little economic importance. Great sums of money are yearly spent on these publications. Purchasers of manufactured products depend upon them for accurate, detailed and timely information. But how often these catalogs fail of their purpose through inadequate or unsuitable presentation of message, through publication in forms difficult to fill, or through haphazard and wasteful distribution!

The Special Libraries Association has become very much interested in the catalog problem. Many of its members are closely identified with the engineering industries. The demands of the user and the efforts of the catalog publisher are brought to a focus on the special librarian's table. The subject, of course, is too large to treat exhaustively in a few pages, but enough has been developed in the investigations of the association to throw considerable light upon the fundamentals of the problem and it is helpful to state its leading aspects, although the association is not proposing at this time to make recommendations. It is merely seeking to get at the facts and to present these in a way that will be suggestive to catalog users and producers.

It may also be of interest to readers of the Electrical World to point out the organization which the association has established to consider this trade catalog problem. For preliminary work has already been initiated through the following subcommittees and their respective chairmen: **Content,** Ellwood H. McClelland, technology librarian Carnegie Library, Pittsburgh; form, E. E. Leason, advertising manager B. F. Sturtevant Company, Hyde Park, Mass.; accessibility, L. A. Armistead; classification, Miss Louise Ayers, librarian Ruben H. Donnelly Corporation, Chicago.

Problem of Content

The material constituting "trade literature" cannot by its nature readily be subjected to standard specifications. Catalogs are designed to achieve their purpose in many different ways and so are bound to vary widely in character. In fact, variety and diversity are advantageous in library service, and any representative collection of trade literature includes catalogs, price lists, publications which have become standard reference works, those describing processes and products, and works which attain the standing of textbooks. Often one publication combines several of these features. In addition, there are many periodical house organs, bulletins, circulars, etc.

Certain desiderata common to all or many of the publications issued include clear, concise and logical language, with effective illustrations, and in general the use of line cuts rather than halftones to illustrate mechanical construction is desirable. Every publication needs a definite, identifying title, and not a mere slogan giving no clew to the subject, scope or character of the publication. Many catalogs suffer in value because the name of the individual or issuing organization does not appear on the titlepage. There is only one correct form for this name, which should be consistently repeated without abbreviations wherever necessary. From the 1923 progress report of this committee the following additional points may be quoted:

Other Desired Standards

The main office or "home office" should be indicated. Frequently a catalog lists on its titlepage a number of cities in which the company is represented, but fails to distinguish between home and branch offices.

Occasionally a publication bears the name of two or more companies. This should be avoided where possible as the custom offers difficulty in cataloging and presents a hazard in subsequent identification of the publication

The date of publication should always be indicated. This should preferably appear at the bottom of the titlepage, and if the publication be copyrighted, the copyright date should appear on the back of the titlepage. The manufacturer who is reluctant to date his publications should realize that the user of the catalog can probably determine the date if he is sufficiently interested, though he will be more likely to turn to the literature of some competitor.

When a publication is revised, the fact should be indicated on the titlepage of the new edition. "Edition 2," etc., is better practice than "New Edition" or "Revised Edition." When one bulletin or circular of a series replaces an earlier one, the new publication should indicate which is superseded.

The numbering of pages should be consecutive and complete. Tables and other data are sometimes appended, but when inclusion of such material is justified it merits pagination, and this should be continuous throughout.

So far as feasible the "running head" should bear the name of the company, the title of the publication and the date of issue. With the increasing prevalence of modern photographic methods of reproduction it is highly desirable that every printed page shall bear the essential data which will identify it on a "photostat" print or other copy. Such identification of pages is complete in the better technical and trade journals published today.

A table of contents is the logical key to the scope and nature of any publication, and such a table should appear in any publication other than a short continuous description or a catalog in which the arrangement of contents is alphabetical. This table of contents should, of course, be arranged in order of sequence of the chapters or divisions of the publication, and its functions should not be confused with those of the index—a mistake frequently made.

A properly made index should identify every item to which a user of the catalog should be referred, and every publication which is intended for reference demands thorough indexing if it is to be used at all effectively. The preparation of an adequate index, with full cross-references to all synonyms, is one of the most important duties of the catalog compiler. The work must be based on correct principles, which cannot be enumerated here, but which

are too infrequently observed and too little understood. Very frequently a catalog otherwise praiseworthy is rendered comparatively worthless by the omission of an index or inclusion of a faulty one.

FORM STILL AN OPEN QUESTION

The problem of form includes the fundamental matter of size (especially as related to filing in standard 8½-in. x 11-in. folders or holders); binding, whether loose-leaf or permanent; cover features and information therefrom; paper stock, arrangement, appeal, typography and facility of distribution. These matters demand thorough discussion, but it must be realized that awkward shapes and excessive size handicap the filing and use of publications and that the catalog producer who tries to make a flashy appeal by adopting inconvenient forms runs grave risk of wasting a large part of his efforts. Waste also results from excessive distribution among officials and subordinates having only very occasional or little real use for catalogs. Thousands of dollars can be saved yearly by putting the mailing list on the defensive. Valuable recommendations upon catalog standardization have been made by the American Institute of Architects and the National Association of Purchasing Agents.

ACCESSIBILITY AND USE

Possibly one hundred special libraries and fifty public libraries in this country handle collections of trade catalogs. The Wisconsin Railroad Commission finds a historical catalog file "indispensable" in its valuation work. Many public libraries have abandoned this work, however, because few firms have kept them on their mailing lists, and the filing and cataloging necessary were often elaborate. Small staffs and restricted space have hampered this service also.

Purchasing departments have relieved fourteen out of seventy-two special libraries of the responsibility for catalog filing. Thirty-seven companies catalog trade literature, thirty-two analyze it, nineteen place cards in the catalog, sixteen treat material as part of the book collection, twenty-six employ vertical files and fifteen shelve catalogs separately. The desirability of a more general approach to standardization along certain lines is apparent. In short, the whole problem of catalog production and use is in a transition stage, and discussion is much to be desired.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

GENERAL business in the electrical trade continues uniformly quiet throughout the country with no marked movements of any importance reported in commodities. There is an evident effort to overcome the dullness of the appliance market by speeding up appliance-selling campaigns. This movement is being initiated by manufacturers and supported by jobbers, and more active sales are reported from many localities.

Central-station buying still forms the backbone of the market. Several sizable orders for central-station equipment are reported from the Middle West and from the Pacific Coast this week. Orders from industrials continue light, and all eyes now seem to be looking ahead toward the break of spring, which will naturally quicken construction and launch the heavy program of home building which is expected this year. Collections are still a bit backward, but money is abundant and there is a general feeling evident that payments will show improvement shortly.

A quiet week in New England, which is considered seasonal, was marked by a five-and-one-half-carload order for conduit. In the New York district electric truck sales are reported as 40 per cent greater than last year and there is a good demand for wire. Intensive sales campaigns on appliances mark an otherwise quiet week in the Southeast district. In the Middle West and on the Pacific Coast there is no outstanding news.

Mine Equipment Business Improving

BUSINESS is increasing in the mine-equipment conveyor and hoist field according to a manufacturer who reports that one hundred large mine locomotives have been ordered by one mining company in Pittsburgh and that several large orders as well as a large number of small orders for other equipment have been received from other sections. Former sales have been made on a low-profit basis, but because of production expenses this manufacturer says that a rise in price of mine equipment—conveyors, hoists, etc.—may be expected shortly. For example, pig iron, which constitutes a large part of the material expense in equipment of the kind mentioned, has been at a very low price and an increase in the price of this raw material is expected as business improves.

Labor and overhead expenses constitute the largest portion of production costs, but the overhead expense is also increasing because of the fact that constant efforts are being made to increase productiveness by installing new machinery like drop-forging gear machines, etc. These afford more uniform and desirable products. While sufficient high-class skilled labor is at present obtainable, it appears that increased business will make it more difficult to obtain. Railroad transportation has been very good indeed, three or four days only being required to ship from Middle West points to Atlantic ports. This condition, it is pointed out, is helpful in handling export business.

Active Demand for Street-Lighting Equipment

STEADILY increasing sales of street-lighting equipment characterize the market at this season, when inquiries are normally extremely active in anticipation of the spring construction period. Since the mid-war years, when there was a decided slump in demand due to the greater need of other apparatus, the curve of sales has mounted regularly until today the country is absorbing much more material of this sort than formerly. Limited appropriations for improved lighting handicap the sale of this equipment in many cases, but recent improvements in apparatus have done much for the buyer and higher standards of illumination are coming to be recognized as necessary for thoroughfares in both town and country. The demand is vigorous from domestic buyers for both arc and incandescent street lamps, and interest in traffic lighting is increasing generally.

Factory stocks are built up on a piecemeal basis in this branch of electrical sales, owing to the great variety of styles of fixtures and allied material now on the market. More competition in this field exists than is generally supposed, chiefly on account of fixture designs and the development of ornamental glassware. Deliveries are in good shape and raw-material stocks are excellent, even in relation to imported supplies. Prices are firm and steady with foreign business rather dull.

Nation-Wide Demand for Vacuum Cleaners

WITH the exception of a "soft spot" in the Northwest, the demand upon representative manufacturers of vacuum cleaners is encouragingly active and the outlook is favorable for a record-breaking year. Large buyers are looking well ahead in planning for resale stocks, and factories are well employed. Labor and material are in ample supply, and prices are steady, with a tendency toward firmness. In some quarters the early expiration of one of the fundamental cleaner patents is regarded as likely to open the door to the introduction of cheaper products to meet the lower-priced trade, but manufacturers of high-grade equipment are confident that they will be able to sell on the quality basis notwithstanding. A representative manufacturer states that many subsequent patents

contribute to the manufacturing of high-class apparatus, and the long life secured is the best justification for the cost of development. The country is far from saturated, and during the next year or two replacement business arising from renewals should begin to supplement new sales.

It is known that the cost of developing new units has not always led to price increases as the new lines have gone upon the market, and among the better class of producers prices are fairly stable for the time being. Deliveries are on a satisfactory basis at present as the milder winter has facilitated transportation. Some attention is being paid to establishing factory stocks, but it is not expected that these will run into large totals in the face of spring business.

There is an encouraging improvement in European trade. The volume of trade may fairly be said to compare favorably with that of a year ago and in noteworthy cases to be somewhat ahead of January of this year.

Automatic Motor-Starting Apparatus Demand Gaining

THE demand for automatic motor-starting apparatus is steadily increasing, largely owing to better protection afforded the motor following the elimination of the human element, increased safety to the operator and improved efficiency in the apparatus controlled. However, the remote-control feature and the added convenience contribute in only a small way to the demand. The automotive and steel industries, to which production is an important factor, are the largest users. Next come baking and other industries where the type of labor is such as to be unfamiliar with electrical apparatus.

For certain other industries also the oil-immersed automatic starter is necessary to reduce fire hazard and to protect against corrosion and dirt. There is a good demand for this type as evidenced by the activities of certain manufacturers who have added it to their former lines. There still remains a large field for the air-break starter, however, due chiefly to the lower first cost, and there does not seem to be any general trend toward the use of oil-immersed equipment. Deliveries vary from stock to eight weeks at longest for larger apparatus, and there have been no price changes for more than a year. Indications are prices will remain firm.

As the control field offers many opportunities for specialties and as engineers differ in their ideas, there are, of course, numerous cases where special apparatus is requested, although the manufacturer has standard apparatus that will do the work. In such cases, if the engineer will modify his requirements, which in most cases can be done without sacrificing any essential feature, the cost of the equipment will be very much decreased as specialties are always, comparatively, more costly.

New England Trade Displays Seasonal Lull

BAD weather and consequent postponed activity in the building industry have brought about a temporary recession in the sale of electrical supplies, but a quick recovery is expected as spring construction gains headway. An interesting order was placed last week-end by a utility company for five and one-half carloads of galvanized conduit. Meanwhile sales of fixtures in one representative house are running 10 per cent over a year ago, storage battery sales for radio and automobile use are selling well, and electric motor sales have slackened off somewhat.

Appliance sales are encouraging, having been materially stimulated by recent campaigns, and domestic refrigerating plants are active in central Massachusetts. Stocks of heaters are being prepared for the spring trade and there is much interest apparent in electric water heating.

Prices have stiffened on porcelain, but in general quotations on supplies are devoid of marked change. Collections are slower, but money is fairly abundant, and credit conditions should improve in the next few weeks.

Electric Truck Sales Increase in New York District

ELECTRIC truck sales in the New York district to date this year are approximately 40 per cent greater than in 1923. The demand for industrial equipment continues fair with larger equipment moving slowly. Utility purchasing is still good, the signing of a large distribution transformer contract being prominent in the week's transactions.

An increase in the price of wire which was made in the last few days by some manufacturers is not yet general, but it is daily expected to become so as quotations made on the old price are good only for immediate delivery. The demand for wire has been noticeably good during the week.

The volume of sales among jobbers has decreased somewhat, although a larger movement is expected by April 1 and good stocks are being maintained to meet the demand. Appliance sales are at present slow, but campaigns planned for the coming week should create a better demand. Prices generally remain firm and collections are said to be improving.

Week Quiet in Southeast District with Steady Volume of Business

THE past week has been quiet, but there is a steady volume of good business in the Southeast district, and jobbers report satisfactory stocks and deliveries. Intensive sales campaigns on appliances, specializing on one device at a time, are meeting with much success. The results obtained so far bear out the wisdom of this policy, and many other campaigns are likely to follow. The outlook for the fan season is excellent, one jobber reporting contracts signed to date 20 per cent in excess of those that were signed last year.

A keen interest has developed in the Southeast district in the promotion of the more complete equipment of homes with all modern conveniences, as evidenced by the fact that during the next few weeks four "better homes" will be exhibited in Atlanta. The electrical features emphasizing the importance of more convenience outlets will be played up strongly by the Atlanta Electrical Association, which will have charge of this phase of the work.

Construction Contracts in Middle West—Radio Sales Decline

SEVERAL sizable construction contracts have been placed by central-station companies in the Middle West this week for transmission equipment and plant improvements, and a number of other projects were figured upon, but the week as a whole has been rather dull.

Radio apparatus sales, which were booming along at a very good rate, have fallen off heavily according to several reports. Reasons advanced for the situation are that the Radio Corporation of America, which recently announced new equipment at reduced prices, has not delivered it and there is no assurance as to when the deliveries will be made, the radio public meanwhile waiting, and that production and delivery of UV-201-A tubes has dropped until it is now practically impossible to buy them.

Business Good on Pacific Coast—Building Construction Active

BUSINESS prospects on the Pacific Coast are brighter because of the recent rain, although cattle losses due to hoof and mouth disease will reflect themselves in several central California counties. Contractors are now especially busy in Los Angeles and San Francisco, and under the stimulus of lower prices on certain types of washers, of "national toast week" and of other such factors retail business is good.

Bids on a pole contract of about $60,000 are now under consideration by the Great Western Power Company. Iron wire is selling in proportionally larger quantities than copper, with keen competition existing, largely as a result of railroad orders for solid and stranded and power orders for stranded.

The Metal Market

THE non-ferrous metal market showed a general decline during the week due largely to declines of the copper market in London. The demand for copper has been very light, consumers showing an unwillingness to commit themselves to any purchases, while producers are holding back and are unwilling to sell at the lower figure. Lead is easier, the supply being more nearly equal to the demand. There has been little buying of zinc, and prices have declined somewhat further this week.

NEW YORK METAL MARKET PRICES

	Mar. 12, 1924 Cents per Pound	Mar. 19, 1924 Cents per Pound
Copper, electrolytic	14	13⅞
Lead, Am. S. & R. price	9.00	9.00
Antimony	11⅛	11¼–11⅜
Nickel, ingot	26	26
Zinc, spot	6.85	6⅝
Tin, Straits	58⅛	53⅛
Aluminum, 98 to 99 per cent	27	27

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Worthington Pump Bookings for 1923 Show Increase

The eighth annual report of the Worthington Pump & Machinery Corporation for the year ended December 31, 1923, shows a material increase in earnings as compared with the preceding two years. The bookings for the year 1923 amounted to $22,155,778, an increase over the previous year of $6,057,046, or about 38 per cent. The billings for the year 1923 amounted to $21,142,263, an increase over the previous year of $6,419,347, or about 44 per cent. Unfilled orders at the close of the year amounted to $5,611,237.

After deducting depreciation and all reserves, including federal taxes, the net income from operations was $1,670,850. After dividends there was added to surplus from net income $660,551. During the year a mutually satisfactory agreement was reached with the United States Treasury finally determining the taxes for the years 1916, 1917 and 1918. After payment in full of these taxes the balance of $1,250,000, from the reserve set aside for this purpose, was added to the surplus, increasing it to $4,295,792. The general reserve of $5,000,000 remains intact.

Iron Products Corporation Buys Crouse-Hinds Guy-Anchor Plant

The Iron Products Corporation, La Crosse, Wis., through a deal concluded in Syracuse by C. R. Pieper, president, has taken over the plant and business of the Crouse-Hinds Company in the manufacture of guy anchors. The machinery is being moved to La Crosse from Syracuse, and in addition two new forging hammers are now being installed. It is expected that within the next thirty days the installation of the machinery at the La Crosse plant will be completed, which will practically double the present capacity.

Electric Storage-Battery Sales and Earnings Show Slight Decrease

The consolidated statement of the Electric Storage Battery Company and the Willard Storage Battery Company for the year ended December 31, 1923, shows net profits of $7,216,522, as compared with $7,570,838 for 1922, before allowance for federal income tax, which for the year 1923 is estimated at $850,000. After allowing for preferred dividends and deducting the federal income tax the earnings on the 797,877 shares of common stock, without par value, are approximately $7.97 a share.

The gross sales for the year 1923, including all expenses incident thereto, were $11,836,030, which was a decrease of $130,651 from 1922. The company is said to have done a larger volume of business in 1923 than in 1922, but at lower prices for some of the products. Present plants are said to be working to capacity.

Gordon Electric to Establish Warehouse in Los Angeles

The Gordon Electric Manufacturing Company, Waterville, Conn., announces that after May 1 a warehouse will be established in Los Angeles where a stock of Gordon porcelain wiring devices as well as wire, conduit fittings, etc., will be carried for distribution to the jobber. Ira R. Seltzer, president and general manager of the company for the last seven years, who is resigning and disposing of most of his interest on May 1, will locate in Los Angeles after that date and will arrange for the establishing of the warehouse.

Brandes Products Corporation Enlarges Newark Factory

The Brandes Products Corporation, manufacturer of radio headsets, etc., a subsidiary of C. Brandes, Inc., 237 Lafayette Street, New York, has started the construction of an addition to its present factory on Mount Pleasant Avenue, Newark, N. J. The new building will be used for the manufacture of parts. This factory is the fourth in the Brandes chain, for besides the plant in New York, there is the Canadian Brandes, Ltd., plant in Toronto and the factory of Brandes, Ltd., in London, where manufacturing is carried on for the European trade.

Western Electric Sales for 1923 Show Good Increase

The total sales of the Western Electric Company during 1923, as obtained from the annual report now available, were $255,177,000, as against $210,941,000 for 1922. These sales are considerably more than was estimated at the beginning of the year and represent the largest volume of business reached by the company in any year.

The net earnings for the year, after providing for the usual depreciation of plant, all taxes and interest on borrowings, were $8,919,513, out of which were paid $1,727,572 dividends on the 7 per cent preferred stock and $5,000,000, equal to $10 per share, on the common stock. The balance of $2,191,941 was carried to common stock.

The unfilled orders aggregate $94,951,000, as compared with $62,069,000 at the end of 1922 and $75,525,000 at the end of 1921. The unusually large volume of unfilled orders is chiefly in large switchboards made to order. In all departments of the company, the report says, the prospects are for great activity during 1924 and for billings substantially exceeding the high record of 1923.

G. E. Ships 50,000-Kw. Turbo-Generator to Detroit Edison

The first unit of three 50,000-kw. turbo-generators has been shipped by the General Electric Company to the Detroit Edison Company for installation in its new Trenton Channel station. The ultimate capacity of this station will probably be about 300,000 kw., of which three 50,000-kw. units are now on order with the General Electric Company and will be put in service during this year. The General Electric Company will also furnish motors for driving auxiliaries in the station in conjunction with this turbine, together with transformers and switching equipment. The transformers are 21,000-kw. units for stepping up the voltage to 132,000 for distribution of power from the station.

Clifton Company Obtains Record Conduit Order

An order for $22,000 worth of galvanized-iron conduit, the largest in the history of the company, was placed through the Hastings Electric Sales Company, South Boston, Mass., with the Clifton Manufacturing Company, Jamaica Plain, Mass., last Saturday by Stone & Webster, Inc., Boston. W. M. Tenney, president of the Clifton organization, states that the order will fill five and one-half cars, the conduit being destined for the new generating plant of the Montaup Electric Company, Fall River, Mass.

Doehler Die-Casting Company Extends Its Facilities

The Doehler Die-Casting Company, Brooklyn, N. Y., announces the recent acquisition of two new plants—one at Batavia, N. Y., and the other at Pottstown, Pa. The Pottstown plant, formerly the Light Manufacturing & Foundry Company, will be operated as the Light Manufacturing & Foundry division of the Doehler Die-Casting Company, specializing in the production of high-quality zinc-alloy die castings as heretofore. The new plant at Batavia, N. Y., will specialize in the production of aluminum die castings. The addition of these facilities to the older plants at Brooklyn, N. Y., and Toledo, Ohio, provide the Doehler Company with a larger capacity for die casting.

Radio Corporation and Brunswick Phonograph Sign Contract

Through an agreement just signed between the Radio Corporation of America and the Brunswick-Balke-Collender Company millions of radio devotees throughout the United States will receive operatic musical programs rendered by famous artists direct from the laboratories of the Brunswick company during the period when its artists are recording for phonograph reproduction. Under this contract the phonograph company gains the right to install "Radiola" receiving sets in combination with Brunswick phonographs. In turn, the phonograph company will add its share to the public

service now rendered by the principal broadcasting stations and will aid in the development of free broadcasting to the public by permitting the stations of the Radio Corporation of America and those of its manufacturing associations to broadcast from its laboratories.

Another interesting provision in the contract is that the technical research facilities of the phonograph company will be placed at the disposal of the Radio Corporation, so that the experiences of both industries will be available for the development of the art in the future.

The Ideal Electric & Manufacturing Company, Mansfield, Ohio, announces that H. B. Joyce has been promoted to the management of agencies and district offices and Harold Goss to the management of the department of synchronous motors. The opening of an office in room 1905, Oliver Building, Pittsburgh, has also been announced. W. M. McKee will be in charge of the office and Thad S. Farnham will travel the territory.

The United Battery Corporation has recently completed arrangements for the purchase of a manufacturing plant in New Paltz, N. Y. The new factory has excellent shipping facilities and after the installation of the machinery is completed will have a capacity of 600 storage cells per day.

The Anaconda Copper Mining Company has received an order for 1,500,000 lb. of copper wire from the Washington Water Power Company. The wire will be manufactured at the Anaconda Company's Great Falls plant.

The Airmap Corporation of America, 30 Church Street, New York, announces a new mapping service on surveys of transmission lines and hydro-electric development sites.

The General Electric Company has received an order for thirty-four oil circuit breakers from the Commonwealth Edison Company. These breakers are to be arranged for vertical phase isolation and will be equipped with hydraulic mechanism similar to that in use at the Crawford Avenue and Calumet generating stations.

The A.A. Wire Company, Newark, N. J., manufacturer of rubber-covered electrical wire, has acquired the former plant of the New Jersey Tube Works, Kingsland Avenue, Harrison, N. J., under lease, with option to purchase, and will take possession early in the fall. The property comprises eight one-story buildings, aggregating close to 160,000 sq.ft. of floor space, and will be equipped for a new plant. It is proposed to remove the existing works to the new location and install considerable additional equipment.

The Hoover Company, North Canton, Ohio, and Hamilton, Ontario, recently placed on the market a new set of air-cleaning attachments for use with its vacuum cleaners. The company also announces the appointment of R. C. Elliott as director of sales personnel.

The Electric Vehicle Company has been organized in Denver by William Wrenton, formerly head of the electric vehicle department of the Public Service Company of Colorado. A selling and service franchise has been secured from the Walker Electric Truck Company of Chicago. R. J. Bardwell and Edgar McComb are also associated with the new enterprise, the headquarters of which have been established at 700 Kittredge Building.

The Benjamin Electric Manufacturing Company, Chicago, has established representation in the mountain region by the appointment of Thomas W. Carlson. He will cover Wyoming, New Mexico and Colorado, with headquarters at Denver.

New Equipment Available

Short Descriptions of New Apparatus and Accessory Equipment of Interest to the Electrical Industry and Available from Manufacturers and Announcements of New Lines

Extension Top and Cross Arms

Extension steel tops for poles and steel cross-arms have been devised by the Toledo Cooker Company, Toledo, Ohio. Extension top arms permit the use of a pole shorter than is customary and do not require cutting a gain or moving a cross-arm. On poles already in service an extra cross-arm can be obtained by the use of these extension top arms. Standard top arms are 3 ft. long, of channel steel 2 in. wide and ¼ in. thick, with an extension of 21 in. These dimensions can be varied to meet various special conditions.

The steel cross-arm is attached with a heavy steel plate which fits against the pole, no gaining being necessary, nor are additional braces required. Two through bolts hold the plate to the pole so that double arming is possible without the use of longer bolts or extra labor. Standard cross-arms are 2-in. x 3-in. x ¼-in. angle-pressed steel with any length or pin spacing, but ⅝-in. steel can be supplied or angles of extra width, such as 2½ in. or 3 in. All the steel used in the extension tops or cross-arms is treated with rust-proof black graphite finish.

Welding Machine

A welding machine called the "Universal" and intended for use on any industrial power supply has been developed by the Electric Arc Cutting & Welding Company, 152 Jelliff Avenue, Newark, N. J. Operation on 110, 220 or 440 volts is obtained by multiple, series-multiple and series combinations of the coils of the primary winding. To make the same machine operate on 25 cycles and 40 cycles, taps and adapter winding are used to obtain the proper electrical characteristics. The blower and the automatic switch are also arranged to operate on these voltages. In addition, the apparatus is also made operative on 110 volts and 220 volts direct current by means of a resistor-reactor combination inserted in the secondary winding.

Selective-Load Control Relay

A selective-load control relay for residential use has been developed by the Automatic Electric Heater Company, Warren, Pa. The relay is mounted on a panel and is intended to be erected on the meter board.

A solenoid-operated two-pole clapper-type switch is controlled by two series magnet solenoids, one in each leg of the 110-220 volt service. These solenoids have adjustable cores which can be set for demands of from 2 kw. to 6 kw. and are shipped adjusted for 3 kw. The primary application of this relay is in connection with a water heater to limit the demand. If the demand of range, lights and appliances should exceed the set value of 3 kw., the water heater will be automatically tripped out of service. When the demand drops below 3 kw. (2-amp. variation) the heater is again thrown into service. It is also possible to control the heater, either manually, full-automatic or with measured service, by a time-switch arrangement when the demand is not exceeded.

Portable Electric Drill.—A portable electric drill, known as the "Speed Way," recently placed on the market by the General Electric Company, is provided with a special series-wound motor in order to make the torque vary inversely with the speed, which, it is said, makes it practically impossible to stall the machine even under the most severe working conditions. Gears on the drill are made of heat-treated alloy steel and run in grease. The control switch is conveniently located under the operator's thumb. The drill is manufactured in several sizes for varied demands.

Flexible Coupling.—A flexible coupling known as the Falk-Bibby and now being manufactured by the Falk Corporation, Milwaukee, is made of specially constructed grid springs of tempered steel set in grooves around the periphery of the coupling flanges. The working parts are inclosed in a floating shell which provides space for packing a lubricant.

Meter Test Switch.—A switch known as the "940" for controlling the current and potential elements for testing polyphase instrument transformer meters has been developed by the Superior Switchboard & Devices Company, Canton, Ohio. The switch is built on a composition base, 3½ in. x 9½ in. x ¾ in., and is provided with insulated handles on each switch unit. Combination wire terminals and corrugated testing ears confine cable strands, give good testing contact and keep test clips from slipping. A good short-circuit clip is provided, milled and slotted brass hexagon nuts are used, and all copper parts are of 30-amp. capacity with no concealed connections. Two flanged screws permit ready connection for making a load test.

New Trade Literature

HOISTS.—Bulletin No. 320 issued by the Pawling & Harnischfeger Company, Thirty-eighth and National Avenues, Milwaukee, describes and illustrates the P. & H. type "U" hoists.

CONDULETS.—The Crouse-Hinds Company, Syracuse, N. Y., is distributing a folder covering its condulets for switch and plug receptacle outlets.

STEAM-HEATING SYSTEMS.—Warren Webster & Company, Camden, N. J., are distributing a booklet entitled "Webster from the Air," which contains aërial photographs of twenty-four representative American cities and gives the names of some of the buildings in each city which are equipped with the "Webster" systems of steam heating.

ELECTRICAL INSTRUMENTS.—"Electrical Savings in Industry" is the title of a booklet issued by the Weston Electrical Instrument Company, 13 Weston Avenue, Newark, N. J. It is designed for the consideration of executives, general managers and engineers of industrial plants using electrical energy and deals with the proper conservation and use of that commodity. It also describes how "Weston" instruments may be used for that purpose.

WIRING DEVICES.—The E. H. Freeman Electric Company, 10 Prince Street, Trenton, N. J., has issued catalog No. 8, which describes and illustrates the complete line of Circular F wiring devices.

CREOSOTED MATERIALS.—The Pittsburgh Testing Laboratory, Pittsburgh, Pa., has issued bulletin No. 33, entitled "Creosoted Materials," which calls attention to its method of wood preservation.

CONTROL EQUIPMENT.—"Supervisory Control" is the title of a pamphlet issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., describing its various supervisory control equipments.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An agency is desired in Auckland, New Zealand (No. 9,510), for flashlights, batteries, electrical toys, novelties and radio batteries.

Purchase and agency is desired in Amsterdam, Netherlands (No. 9,504), for electric lighting material.

An agency is desired in Stockholm, Sweden (No. 9,511), for lighting supplies and other electrical goods and for radio apparatus and parts for both crystal and tube sets, best quality.

An agency is desired in Genoa, Italy (No. 9,474), for electrical machinery and generators and radio apparatus.

An agency is desired in London, England (No. 9,509), for mechanical machinery, equipment, specialties and appliances.

Purchase and agency is desired in Santos, Brazil (No. 9,470), for radio apparatus.

An agency is desired in Lisbon, Portugal (No. 9,471), for radio apparatus.

An agency is desired in Liège, Belgium (No. 9,472), for varnished-cambric cloth tape, and friction tape.

Purchase is desired in Port au Prince, Haiti (No. 9,473), of electric match-making machine.

The following inquiries have been received by the Philadelphia Commercial Museum, Thirty-fourth below Spruce Street, Philadelphia, which will furnish names and addresses of inquirers to any one desiring them and mentioning the number given: A party in Rajputana, India (No. 41,752), is contemplating a scheme for lighting the city of Jaipur and supplying electric fans and would like to receive price lists, illustrations, etc., of electric goods, etc. Parties in Bombay, India (No. 41,756), would like to correspond with manufacturers of all classes of electrical goods, including switches, cables, insulators, lighting fixtures, lamps, generators, accumulators, copper wire and tubes, etc., with a view of securing an agency. Parties in Manchester, England (No. 41,767), would like to get in touch with American manufacturers of hard fiber for electrical purposes in the form of sheets, rods and tubes. Parties in Auckland, New Zealand (No. 41,776), are seeking agencies for equipment and material for hydro-electric power plants, etc.

TENDERS FOR EQUIPMENT FOR LAKE COLERIDGE POWER SCHEME, NEW ZEALAND.—Tenders will be received by the Public Works Tenders Board, Wellington, New Zealand, until July 29 for equipment for the Lake Coleridge power scheme, Section 146, including two water turbines complete with governors, set of spare parts and tools, two main valves complete, two generators complete, one spare set of field coils, one spare set of armature coils and insulating materials, one spare rheostat, and twelve rheostat grids complete with operating motor, one spare set field brush holders and brushes, one complete bearing shell, two sets of temperature indicating coils, leads and indicator complete, and services of supervising engineer. (No. S.M. 186.)

New Incorporations

THE PUBLIC SERVICE POWER COMPANY, Richmond, Va., has been incorporated with a capital stock of $100,000. The officers are Cyrus W. Beale, president, and Guy B. Hazlegrove, secretary.

THE COLUMBUS (TEX.) POWER & LIGHT COMPANY has been organized to build a hydro-electric plant on the Grand River near Columbus. The officers are A. S. McDaniel, San Antonio, president, and O. A. Zunwalt, secretary.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

OAKLAND, ME.—The Central Maine Power Company contemplates building a new electric power plant in Oakland. F. H. Mason, Waterville, is engineer.

SPRINGFIELD, MASS.—Bids will be received at the office of the City Clerk, Springfield, until April 8, for furnishing and installing three vertical-shaft electric motor-driven centrifugal sewage-pumping units, switchboard, electric control apparatus and auxiliary equipment. Metcalf & Eddy, Boston, Mass., are consulting engineers.

WORCESTER, MASS.—The American Steel & Wire Company plans to install electric power equipment in the addition to be built at its South Works for heavy cable production.

Middle Atlantic States

BINGHAMTON, N. Y.—The Binghamton Light, Heat & Power Company is negotiating with the village boards of Green and Newark Valley for the purchase of the municipal electric plants in both villages. If the systems are taken over, the transmission line will be extended from Owego.

GOSHEN, N. Y.—The Orange & Rockland Transmission Company and the Orange & Rockland Electric Company have been granted permission by the Public Service Commission to extend their lines and to operate in the town of Goshen.

JAMESTOWN, N. Y.—Plans are under way for extensions to the municipal electric light plant, including an extension to power house. The Board of Public Utilities has authorized bids for the following: Until April 3, for a generator, air cooler and for structural steel and foundations at power plant; also, until April 15, for construction of a concrete reservoir.

KINGSTON, N. Y.—The Kingston Gas & Electric Company has applied to the Public Service Commission for permission to extend its transmission lines into Olive Township to supply electrical service there.

NARROWSBURG, N. Y.—The Tusten Light & Power Company has applied to the Public Service Commission for permission to take over the local electric light and power system now operated by Robert Huebner and for authority to operate here under the local franchise. It is also stated that the local authorities desire to secure street-lighting service.

TOMPKINSVILLE, N. Y.—Bids will be received by the Superintendent of Light Houses until March 25 for 375 dry cells, 2½ in. x 6 in. (Proposal 16,685.)

WATERTOWN, N. Y.—The International Paper Company, contemplates equipping three of its mills in this section for electrical operation, replacing the water-power service now in use.

WATERTOWN, N. Y.—Plans have been prepared by the Power Corporation of New York, Northern New York Trust Company Building, for the erection of a double three-phase, high-tension, steel-tower transmission line from Booneville to Rome, about 24 miles. W. Creager is chief engineer.

BRANCHVILLE, N. J.—The New Jersey Power & Light Company has arranged for the purchase of the property of the Branchville Electric Company. Extensions are contemplated to the transmission lines and also to furnish service in adjoining territories.

LIVINGSTON, N. J.—The Central Jersey Power & Light Company is planning to install an improved lighting system on Mount Pleasant, Hillside and Beaufort Avenues.

WHIPPANY, N. J.—The Agar Manufacturing Company, 167 Forty-first Street, Brooklyn, N. Y., plans to install electric power equipment at its proposed local paper mill, to cost about $100,000.

ALLENTOWN, PA.—The Cherry Ridge Power & Light Company and the Bethany Power & Light Company, recently organized, plan to erect transmission lines in the respective territories for which they are named. C. M. Walter, Allentown, is treasurer of both organizations.

HARRISBURG, PA.—The City Council is planning to replace the single standards mounted with 100-watt lamps on the Mulberry Street bridge with cluster standards carrying 300-watt lamps.

PHILADELPHIA, PA.—Plans are being prepared by the Philadelphia Electric Company for the erection of a substation at Main and Green Streets, Manayunk.

TAMAQUA, PA.—The Lehigh & New England Railroad Company, 437 Chestnut Street, Philadelphia, plans to install electric power equipment at its proposed local repair shops, to cost about $250,000.

WEATHERLY, PA.—The Pennsylvania Power & Light Company, Allentown, is negotiating for the purchase of the municipal power plant. If taken over extensions are planned to the transmission system in this district.

BALTIMORE, MD. — The Consolidated Gas, Electric Light & Power Company plans to build a substation at 2530 Woodbrook Road, to cost about $50,000.

HAGERSTOWN, MD. — The Tidewater Steel Company, Baltimore, plans to install electric power equipment at its proposed local mill, to cost about $150,000.

BUCKHANNON, W. VA.—The Monongahela-West Penn Public Service Company, Fairmont, has acquired the property of the Buckhannon Light & Water Company. Extensions to the system in this section are contemplated.

MANASSAS, VA.—The town officials are considering the erection of a brick or tile smokestack, 100 ft. x 48 in., at the municipal water and light plant, to replace the steel stacks recently destroyed by storm. Frank Gue, Jr., is superintendent.

NORFOLK, VA.—The Hampton Roads Coal & Bunkering Corporation plans to install electric power equipment at its proposed coal storage and distributing plant on the inner harbor waterfront, to cost about $120,000. M. A. Butler is engineer.

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, until March 31, for one switchboard (Proposal CP 15933-A-3); also, until March 25, for firing signal sets (Proposal CP 16766-1).

WASHINGTON, D. C.—Bids will be received by the General Purchasing Officer, Panama Canal, until April 3, for panelboards, telephone cable, meters, etc. (Circular 1569.)

North Central States

BERKLEY, MICH.—The installation of an electrically operated pumping plant in connection with the proposed municipal waterworks, to cost about $250,000, is under consideration by the City Council. R. A. Murdock, Free Press Building, Detroit, is engineer.

DETROIT, MICH.—The Detroit Edison Company has secured authority to issue $6,800,000 in capital stock, part of the proceeds to be used for proposed extensions and improvements.

DETROIT, MICH.—Plans for the proposed assembling works, to be erected by the Ford Motor Company at Puerto, Mexico, at a cost of about $450,000 include a power house.

FARMINGTON, MICH.—Plans are being prepared by Stratton & Snyder, Union Trust Building, Detroit, for dormitories with detached power house and laundry, dining room and service building, etc., for the Ford Republic School.

CINCINNATI, OHIO.—The City Council has passed a resolution requesting the city engineer to make an estimate of the cost of installing an ornamental lighting system on Gilbert Avenue between Morris Place and Locust Street.

CLEVELAND, OHIO.—The installation of an ornamental lighting system on West Boulevard from Lorain to Linnett Avenues has been ordered by Park Director Harmon.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until March 28, for forced-air ducts for the Division of Light and Power.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until March 28 for distributing transformers for the Division of Light and Power.

HAMILTON, OHIO. — Steps have been taken by business firms and property owners on Second Street between Dayton Street and Central Avenue for the installation of an ornamental lighting system. The cost is estimated at about $20,000.

TOLEDO, OHIO.—Plans for the proposed local food-manufacturing plant to be erected by the H. J. Heinz Company, Pittsburgh, Pa., include a power house. The cost is estimated at about $750,000.

DANVILLE, KY.—The City Council has granted the Kentucky Utilities Company a franchise to furnish electric service in Danville.

GARY, IND.—The Calumet Power Company, recently incorporated, it is reported, will erect a "superpower" transmission line from the Calumet power station of the Commonwealth Edison Company, South Chicago, through Hammond and Gary to Aetna, Ind., where a substation with a capacity of 55,000 hp. will be built.

HAMMOND, IND.—The Northern Indiana Gas & Electric Company has petitioned the Public Service Commission for authority to issue $3,427,000 in bonds to provide funds for improvements and acquisitions for its electric and gas properties this year. About $550,000 will be expended in the Hammond district for extensions, etc., to the electric system. Improvements will be made to both the electric and gas systems in Michigan City, to cost about $300,000. At Lafayette improvements will be made in both the electric and gas plants, to cost about $130,000.

BELLEVILLE, ILL.—Bids will be received by the Engineering Division, Air Service, Scott Field, until March 26, for electric switchboard equipment and lighting apparatus for the local station. (Circular 1.)

METROPOLIS, ILL.—Bids will be received by the city of Metropolis until April 7 for improvements to the municipal electric plant and water works, to cost about $130,000. The W. A. Fuller Company, St. Louis, is consulting engineer.

BURLINGTON, WIS.—Plans have been prepared by the Burlington Blanket Company for doubling the electric generating capacity of its power plant.

MARSHFIELD, WIS. — Arrangements have been completed by the Light and Water Commission to erect a transmission line from the municipal electric plant to Hewitt to furnish electricity there and to farmers along the proposed line.

MENESHA, WIS.—The City Council is considering submitting to the voters the proposal to install a new electric generating unit in the municipal electric and water plant, to cost about $55,000.

MILWAUKEE, WIS. — The Milwaukee Electric Railway & Light Company is considering extending its electric service to farmers in the vicinity of Golden Corners.

REEDSBURG, WIS.—Arrangements are being made by the Council to extend the service of the municipal electric plant to new territory north of the Baraboo River. The cost of the line extension will be paid by the consumers.

CANNON FALLS, MINN.—The Cannon River Hydro-Electric Company contemplates a hydro-electric development on Cannon River, 3 miles below here, to cost about $250,000. J. H. A. Brahtz, Metropolitan Opera House Building, St. Paul, is engineer.

WINONA, MINN.—Plans are being prepared by Mead & Seastone, Journal Building, Madison, Wis., for an addition to the local boiler plant of the Wisconsin Light & Power Company.

FAIRFIELD, IOWA.—The Oakland mill water-power project on Skunk River has been acquired by the Iowa Electric Company, which plans to increase the output to 800 hp. The present capacity is 250 hp. The work will include raising of the dam and the installation of new machinery. The cost is estimated at about $210,000.

SIOUX CITY, IOWA.—The question of installing ornamental lamps on Morningside Avenue is being agitated. The installation of ornamental lamps on several blocks in the vicinity of Peters Park is under consideration.

HANNIBAL, MO.—Plans are being prepared for extension to the water system, including a filter plant equipped with motor-driven, low and high-service pumping machinery of 6,000,000 gal. capacity. The cost is estimated at about $350,000. Burns & McDonnell, Interstate Building, Kansas City, Mo., are engineers.

OMAHA, NEB.—The erection of three high-tension transmission lines with a total length of about 250 miles, to cross the Missouri River at least twice, is to be undertaken this year by the Continental Gas & Electric Corporation. A 132,000-volt or 150,000-volt steel-tower transmission line (about 175 miles) will be built to connect the Iowa and the Nebraska properties of the Continental company with its recently acquired property in Kansas City. From Lincoln to Plattsburgh a 66,000-volt line 60 miles long, will be erected, connecting the systems of the Lincoln Gas & Electric Company with the Nebraska Gas & Electric Company and the Iowa Service Company. Voltage on the line from Plattsmouth across the Missouri River to Malvern, Iowa, 20 miles long, will probably be raised from 33,000 volts to 60,000 volts. The transmission line (33,000 volts) of the Nebraska Gas & Electric Company from Norfolk to Tekamah will be extended across the Missouri Valley, Iowa, a distance of 20 miles, to give an additional tie-in.

NEWTON, KAN.—The City Council is having plans prepared for a steam power plant, smokestack, 5-ton traveling crane, etc., to cost about $45,000. E. T. Archer & Company, New England Bank Building, Kansas City, Mo., are engineers.

Southern States

ROUGEMONT, N. C.—W. A. Carver, Rougemont, contemplates purchasing a waterwheel and auxiliary equipment for a proposed local water-power development.

EASLEY, S. C.—Steps have been taken by farmers residing between Easley and Greenville to organize a company to erect a rural community electric line to secure electrical service. L. M. Bauknight is a member of the committee to carry out the organization.

QUITMAN, GA.—The Valdosta Lighting Company, Valdosta, plans to extend its transmission line from Valdosta to furnish electrical service. The cost is estimated at about $60,000.

THOMASVILLE, GA.—Bids will be received by E. M. Smith, Jr., City Clerk, until March 24 for equipment for the municipal power plant, including one 700-kw. steam turbine, with generator and auxiliary equipment, steam boiler, etc.

THOMASTON, GA. — The Flint River Power Company, a subsidiary of the Central Georgia Power Company, Macon, is preparing plans for the construction of a hydro-electric plant, near Thomaston, with transmission line to Macon. The cost is estimated at about $500,000.

HOMESTEAD, FLA.—The Redland Light Company, recently organized, is planning to erect a transmission line from Homestead into the Redland district proper. B. E. Eackman is interested in the project.

NASHVILLE, TENN. — The Nashville Pulp & Paper Company is reported to be planning to build a power plant in connection with its proposed paper mill, to cost about $800,000.

GULFPORT, MISS.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until March 26, for an automatic telephone system for the local United States Veterans' Hospital. (Specification 4957.)

NATCHEZ, MISS. — The Natchez Ice Company plans to install a generating unit at its local plant for light and power service.

ALEXANDRIA, LA.—Preliminary plans are being prepared for building a 255-mile canal connecting Red and Calcasieu Rivers in connection with the Louisiana Canal. The project includes five hydro-electric plants, to develop 110,020 hp., and five reservoirs having a capacity of 1,866,040 acre-ft. The cost of the project is estimated at $8,700,000. W. Bradford, Alexandria, is president.

LOREAUVILLE, LA. — The Loreauville Sugar Company Inc., plans to install additional electrical equipment, including a three-phase, 60-cycle generator, with exciter, switchboard, instruments, etc.

SHREVEPORT, LA.—The Arsenic Compound Company, recently organized, is reported to be planning to build a power house at its proposed local chemical compound works. T. B. Weatherby is president.

CUSHING, OKLA.—Plans for the proposed extensions to the municipal waterworks include dam, filter plant, motor-driven centrifugal pumps, etc., for which a bond issue of $407,000 will be voted on.

HENRYETTA, OKLA. — The Oklahoma Power Company contemplates extensions and improvements in its power plant, including installation of new equipment, to cost about $25,000.

BRADY, TEX.—The Council is considering an issue of $100,000 in bonds for extensions to the municipal electric plant, including the installation of electrically operated pumping machinery.

COLUMBUS, TEX. — The Columbus Power & Light Company, recently organized, plans to build a hydro-electric plant on the Colorado River, near Columbus, for which application was recently made. The project will include a transmission system. The cost is estimated at about $500,000. A. S. McDanjel, San Antonio, is president.

DALLAS, TEX.—The Board of Works has preliminary plans under consideration for the installation of a hydro-electric power plant for municipal service, in connection with a proposed reservoir for the city waterworks. The cost of the entire project is estimated at about $5,000,000. The power station will have an initial output of about 2,500 hp.

FORT WORTH, TEX.—The Fort Worth Power & Light Company contemplates line extensions in the suburban district and additions to street-lighting systems, to cost about $450,000.

PEARSALL, TEX.—The Texas Central Power Company, San Antonio, has acquired the plant of the Pearsall Water, Ice & Light Company. Extensions are contemplated, including the installation of a Diesel engine, etc.

Pacific and Mountain States

KALAMA, WASH.—The city officials have applied for permission to utilize water from the Kalama River for a 23,600-hp. hydro-electric development. The cost is estimated at $2,000,000.

KELSO, WASH. — Petitions are being circulated for the installation of a cluster-lamp lighting system in the principal business streets.

SEATTLE, WASH.—The Northern Railway Company plans to install an ice and refrigerating plant in connection with its new local fruit-storage building, to cost about $115,000.

SEATTLE, WASH.—Plans for the proposed local maple-syrup manufacturing plant to be erected by the Towle Log Cabin Products Company, St. Paul, Minn., to cost about $300,000, include a power house.

SILVERDALE, WASH.—Application has been made by Louis C. Morey, Silverdale, for permission to construct a power plant on Chico Creek to furnish local commercial service.

SPOKANE, WASH.—Bids, it is said, will soon be asked for the installation of a lighting system on North Monroe Street.

TACOMA, WASH.—Bids will be received at the office of the Commission of Light and Water, Tacoma, until April 16 for machinery and equipment for the Cushman power project, consisting of two 27,500-hp. hydraulic turbines, three 20,000-kva. generators, seven 6,667-kva., four 14,100-kva., six 150-kva. and three 3,333-kva. transformers and one 15,000-kva. synchronous condenser and auxiliaries. Ira S. Davisson is Commissioner of Light and Water.

FREEWATER, ORE.—The Pacific Power & Light Company, Portland, plans to rebuild its transmission line along the Walla Walla River in this section.

FREEWATER, ORE.—H. S. Freeman, Freewater, and associates have applied for permission to build a hydro-electric power plant on the Walla Walla River, with initial output of 1,275 hp., to cost about $140,000.

TERREBONNE, ORE.—H. V. Gates, Terrebonne, and associates, have applied for permission to build a hydro-electric power plant on Crooked Creek, to cost about $100,000.

CARMICHAEL, CAL.—At a special election held recently the proposal to issue $60,000 in bonds for the construction of an electric distributing system, in the Carmichael public utility district was defeated.

LONG BEACH, CAL.—The Long Beach Bath House & Amusement Company contemplates the construction of a power plant for service at its various local enterprises. Walter Hasendahn, 1213 Fuller Avenue, Los Angeles, is consulting engineer.

MODESTO, CAL.—The City Council has authorized plans for the installation of an ornamental lighting system, with underground conduits, in part of the business district. F. W. McCarton is city engineer.

MONTE VISTA, CAL.—The West Ontario Citrus Association plans to install an ice and pre-cooling plant in connection with a new packing house, to cost about $200,000.

ORANGE, CAL.—The City Council is considering plans for the installation of an ornamental lighting system on a number of streets.

PALO ALTO, CAL.—Plans are under consideration for the installation of an ornamental lighting system on Emerson Street from University to Hamilton Avenues. J. F. Bxybee, Jr., is city engineer.

PORTERVILLE, CAL. — The Valdalia Irrigation District is considering the construction of a series of electrically operated pumping plants in connection with its proposed irrigation system, for which a bond issue of $210,000 has been approved.

UPLANDS, CAL.—Plans are being prepared by the Standard Rock Crushing & Gravel Company for the installation of a new rock-crushing plant, including a power house, to cost about $250,000.

AMERICAN FALLS, IDAHO. — Work will soon begin on the erection of a new government transmission line from American Falls to Declo, a distance of about 48 miles. The cost of the proposed line is estimated at between $60,000 and $65,000.

OGDEN, UTAH.—Steps have been taken by the Chamber of Commerce to secure a number of municipal improvements, including an improved street-lighting system in the business district and the installation of additional lamps in the city parks.

DENVER, COLO.—Extensions and improvements, to cost about $3,000,000, are contemplated by the Colorado Fuel & Iron Company at its Minnequa plant, the most important of which is the installation of electrical precipitators for the cleaning of furnace gas.

LOVELAND, COLO.—The City Council, it is reported, plans to award the contract for the proposed municipal electric plant. The Public Service Company of Colorado, which furnishes the local service, has filed a protest with the State Public Utilities Commission.

Canada

FREDERICTON, N. B.—The provincial government has authorized plans for the construction of a hydro-electric plant near Grand Falls, St. John River, with initial installation of about 75,000 hp.

ESSEX, ONT.—The provincial government has appropriated $200,000 for the installation of a transformer in the local substation of the Hydro-Electric Power Commission of Ontario.

KITCHENER, ONT.—The City Council is considering the installation of an ornamental lighting system on King Street, to cost about $35,000. S. Shupe is City Engineer.

MIDLAND, ONT. — The Hydro-Electric Power Commission of Ontario (Severn System) contemplates further development to provide additional service in Midland, for which an appropriation of $645,000 has been made.

ORILLIA, ONT.—The Orillia Light & Power Commission contemplates erecting a transmission line from Orillia to the power house at Swift Rapids, to cost about $40,000. R. H. Starr, Orillia, is engineer.

LA TUQUE, QUE.—The Town Council is considering a power development on Petite and Grande Rivers, near La Tuque, to cost about $50,000.

Electrical Patents

Announced by U. S. Patent Office

(Issued March 4, 1924)

1,485,358. ELECTROLYTIC CONDENSER; C. T. Allcutt, Pittsburgh, Pa. App. filed Dec. 30, 1919. Satisfactory power factor under continuous operating conditions.

1,485,361. MEANS FOR SUPPRESSING THE GROUND CURRENTS; R. Bauch, Berlin-Charlottenburg, Germany. App. filed July 6, 1921. In high-tension systems using transformer.

1,485,366. STARTING DYNAMO FOR MOTOR VEHICLES; E. Bugatti, Molsheim, France. App. filed Aug. 25, 1921. To be used as motor or generator.

1,485,375. CONTROL MECHANISM FOR INDUCTION MOTORS; A. M. Dudley, Oakmont, Pa. App. filed Nov. 4, 1918. For controlling speed.

1,485,393. FIELD MAGNET POLE PIECE FOR DYNAMO-ELECTRIC MACHINES; D. Hall, Wilkinsburg, Pa. App. filed Feb. 4, 1918. With non-magnetic portions intersecting the flux path.

1,485,397. TRAVELER'S IRON; H. Kreisheld, Mansfield, Ohio. App. filed Jan. 3, 1920. Sadiron, easily disassembled.

1,485,409. SPEED REGULATOR SYSTEM; L. Miller, Manchester, England. App. filed Sept. 2, 1921. For maintaining constant the speed ratio between a plurality of rotatable members.

1,485,431. SYSTEM OF CONTROL; R. Rudenberg, Berlin-Grunewald, Germany. App. filed Dec. 15, 1920. Overspeed protection for dynamo-electric machines (turbine-driven or otherwise).

1,485,436. MEANS FOR PREVENTING OCCLUSION OF HYDROGEN IN METAL CATHODES; J. Slepian, Wilkinsburg, Pa. App. filed Jan. 12, 1920. Method of electroplating ferrous articles.

1,485,459. ARC WELDING; E. Gruenfeldt, Cleveland, Ohio. App. filed Feb. 13, 1922. Applied to relatively thin sheet-metal parts.

1,485,461. ELECTROLYTIC CELL; A. E. Knowles, Heswall, England. App. filed July 13, 1922. For use in the commercial production of oxygen and hydrogen by the electrolysis of water.

1,485,462. ELECTRICAL APPARATUS; F. Lowenstein, New York, N. Y. App. filed Dec. 2, 1919. Improved variable inductance and contact clip means which are suitable for use in conjunction with radio signaling apparatus.

1,485,473. ELECTROLYTIC CELL; H. I. Allen Portland, Me. App. filed March 14, 1922. Used for decomposition of electrolytes.

1,485,485. RADIO SIGNALING; H. G. Cordes, Bremerton, Wis. App. filed Sept. 29, 1919. To prevent or reduce the effect of certain electrical atmospheric disturbances or static.

1,485,505. PROCESS FOR INTRODUCING ALKALI OR EARTH ALKALI METALS IN DISCHARGING TUBES AND THE LIKE; G. Holst and E. Oosterhuis, Eindhoven, Netherlands. App. filed Oct. 26, 1920. To obtain high vacuum in vacuum tubes (lamps, etc.).

1,485,524. CRYSTAL DETECTOR FOR RADIO INSTRUMENTS; H. H. Pickron, Rock Island, Ill. App. filed March 9, 1923. Improving the character of the engagement between the contact member and the mineral.

1,485,533. DYNAMO-ELECTRIC MACHINE; A. N. Sammarone, Akron, Ohio. App. filed May 9, 1921. Light-weight, made by stamping adaptable parts out of sheet metal.

1,485,538. SOUND-DETECTING APPARATUS; W. L. Walker, New York, N. Y. App. filed Jan. 4, 1918. For detecting sounds in water and for submarine signaling.

1,485,542. ELECTRIC CONTROLLER; R. E. Weimer and M. A. Speicher, Colliers, W. Va. App. filed May 19, 1922. Resistance type for direct-current machines.

1,485,650. GENERATING HARMONIC CURRENT; H. J. Vennes, New York, N. Y. App. filed April 28, 1919. From a source of alternating voltage by the use of an electron discharge relay.

1,485,660. TELEPHONE SYSTEM; G. A. Yanochowski, Chicago, Ill. App. filed Sept. 30, 1918. Automatic systems of the two-wire type.

1,485,666-1,485,667. ELECTRIC HEATER; J. R. H. Coldwell, Winnipeg, Manitoba, Canada. App. filed March 23, 1922. To heat the water of the cooling system of internal-combustion engines.

1,485,675. MULTIPLEX TELEGRAPHY; R. V. L. Hartley East Orange N. J. App. filed Sept. 29 1919. Transmission of signals by means of high-frequency waves.

1,485,706. METHOD OF CARRYING OUT ELECTROCHEMICAL REACTIONS AND APPARATUS FOR USE THEREIN; G. Plauson, Hamburg, Germany. App. filed March 13, 1922. Wherein the anode has a small surface in relation to the cathode so that it can be heated to a high temperature.

1,485,707. SEPARATOR FOR STORAGE BATTERIES; R. W. Portmann, Norwood, Ohio. App. filed July 5, 1922. Made of any material, louver-type construction.

1,485,727. VOLTAGE BOOSTING OF BUCKING SYSTEM; M. L. Sindeband, New York, N. Y. App. filed Sept. 20, 1920. Feeder regulator of the static type.

1,485,740. REVERSIBLE DOUBLE-VOLTAGE GENERATOR AND SYSTEM INVOLVING SAME; W. A. Turbayne, Niagara Falls, N. Y. App. filed Nov. 17, 1917. Rotary-converter.

1,485,741. DYNAMO-ELECTRIC MACHINE; W. A. Turbayne, Niagara Falls, N. Y. App. filed Dec. 19, 1918. Direct-current converter in a single machine.

1,485,742. GENERATOR SYSTEM; W. A. Turbayne, Niagara Falls, N. Y. App. filed Aug. 11, 1919. For conditions involving great fluctuations in current and voltage and in which it is desirable to maintain a stiff generator field under heavy loads.

1,485,743. GENERATOR SYSTEM; W. A. Turbayne, Niagara Falls, N. Y. App. filed Nov. 8, 1919. Having a plurality of circuits which operate at different voltages as a storage-battery and translation-circuit system.

1,485,744. WELDING GENERATOR; W. A. Turbayne, Niagara Falls, N. Y. App. filed Nov. 22, 1920. Providing a variable voltage which will inherently develop the desired voltage-current characteristic.

1,485,755. ELECTRIC PROCESS FOR THAWING CARCASSES OF FROZEN MEAT AND THE LIKE; A. U. Alcock, Melbourne, Victoria, Australia. App. filed May 13, 1919. By passing current directly through material to be thawed.

1,485,773. RADIO CALLING OR SIGNALING; L. Espenschied, Queens, N. Y. App. filed Sept. 12, 1921. By suppressing transmission of carrier wave.

1,485,776. MARINE SIGNALING APPARATUS; J. K. M. Harrison, Ogontz, Pa. App. filed Jan. 3, 1920. By emission of radio signals; power provided by a galvanic cell forming part of the buoy and functioning on the galvanic-couple principle with the sea water.

1,485,856. ELECTRIC GENERATOR; J. Kjekstad, Brooklyn, N. Y. App. filed June 27, 1919. For system including co-ordinated electric lighting and electric arc-welding circuits.

1,485,865. CONTROL AND REGULATION OF ENERGY CONVERSION MACHINES; F. W. Meyer, Milwaukee, Wis. App. filed Feb. 12, 1920. Machines convert the energy in a fluid into kinetic energy and are subject to varying speed, load and power conditions.

1,485,869-1,485,870. SIGNALING SYSTEM; C. A. Nash, Chicago, Ill. App. filed Sept. 28, 1921. Using a relatively high-voltage direct-current service to energize a relatively low-voltage signaling circuit.

1,485,883. SIGNALING-TRANSMITTING DEVICE; E. J. Quinn, Ringsend, Ireland. App. filed Feb. 15, 1922. Automatic; for wireless, flashlight and land-line systems of telegraphy.

1,485,890. HOT PLUG; H. F. Shepherd, Grove City, Pa. App. filed Oct. 13, 1921. For explosive engines.

1,485,912. PHONOGRAPH CONNECTION FOR TELEPHONE RECEIVERS; J. J. Ghegan, East Orange, N. J. App. filed April 13, 1923. To adapt phonograph as "loud speaker."

1,485,918. TELEPHONE MOUTHPIECE; H. S. Hearn, Denver, Col. App. filed Jan. 22, 1923. Of special contour, shaped somewhat like the human ear.

1,485,931. COUPLING AND TUNING APPARATUS; A. A. Kent, Ardmore, Pa. App. filed Oct. 30, 1922. Combined with a coil support is a variometer structure whose windings coact with the coil on the support.

1,485,932. SWITCHING SOCKET; T. J. Kerwin, Chicago. Ill. App. filed Aug. 1, 1921. For use with cowl lamps or instrument-board lamps of automobiles.

1,485,942. CONNECTION FOR CARBON BRUSHES AND THE LIKE; C. W. Adams, Saginaw, Mich. App. filed April 25, 1923. Method of fastening "pigtails."

1,485,964. LAMP SOCKET; J. Cuthbert, Chicago, Ill. App. filed Dec. 4, 1916. Means for securing the mechanism to the inclosing shell or casing and for securing the latter to a socket-supporting fixture.

1,485,992. MAGNETO CONSTRUCTION; E. B. Nowosielski, Bloomfield, N. J. App. filed Oct. 30, 1920. All available space utilized so as to reduce the over-all length.